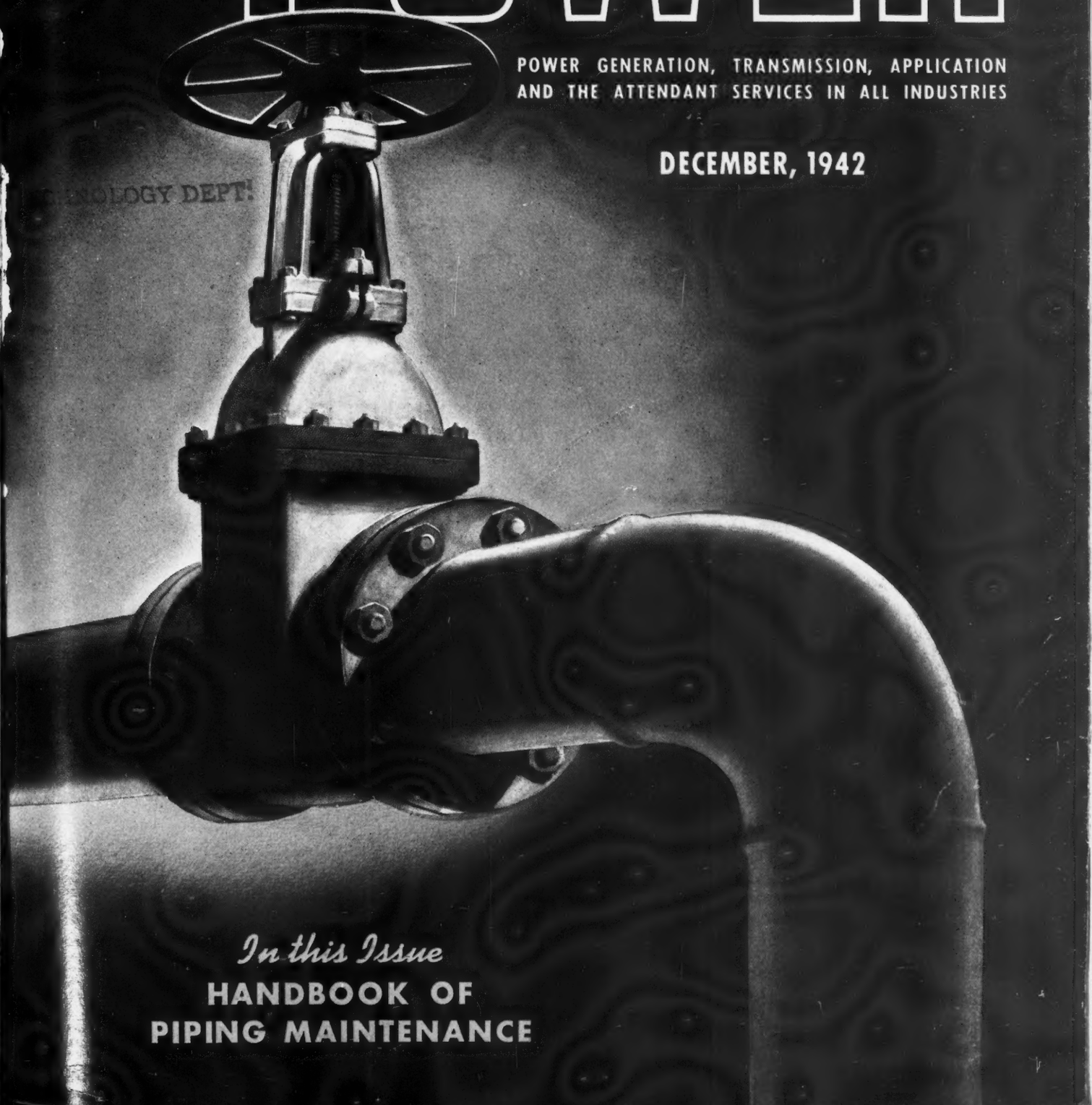
POWER

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRIES

DECEMBER, 1942

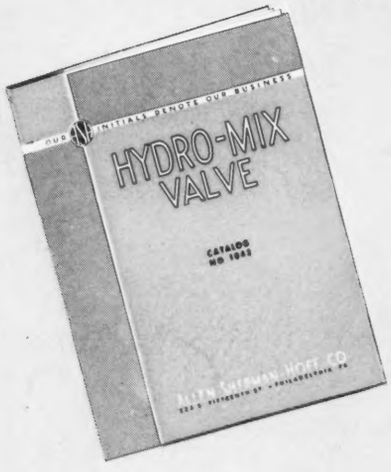
OLOGY DEPT.



In this Issue

HANDBOOK OF PIPING MAINTENANCE

NEW



Read and See How
The Hydromix Dust Valve Actually Works
Write For Bulletin No. 1042.

The Hydromix Dust Valve is "New," but its operating principles are simply a combination of known, commonplace, every-day facts and tools, as schematically typified by the above illustration. The Hydromix Valve handles dust as discharged from dust collectors, mixing this dust with water and discharging the mixture to a point of disposal, all without any manual attention, the entire operation being accomplished without any infiltration of air through the valve to the dust collector. The removal of dust may be continuous or intermittent. There are **no moving parts** to the system, **minimum headroom** is required, and an extremely **small amount of water** is used. There is **substantially no wear** on the discharge piping and, as the system is totally enclosed, there is **no dust nuisance** at the plant.

HYDROMIX DUST VALVE

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA • Offices & Representatives in Principal Cities

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), December, 1942, Vol. 86, No. 12. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

LINK-BELT Bulk-Flo

THE SELF-FEEDING SELF-CLEANING ELEVATOR-CONVEYOR

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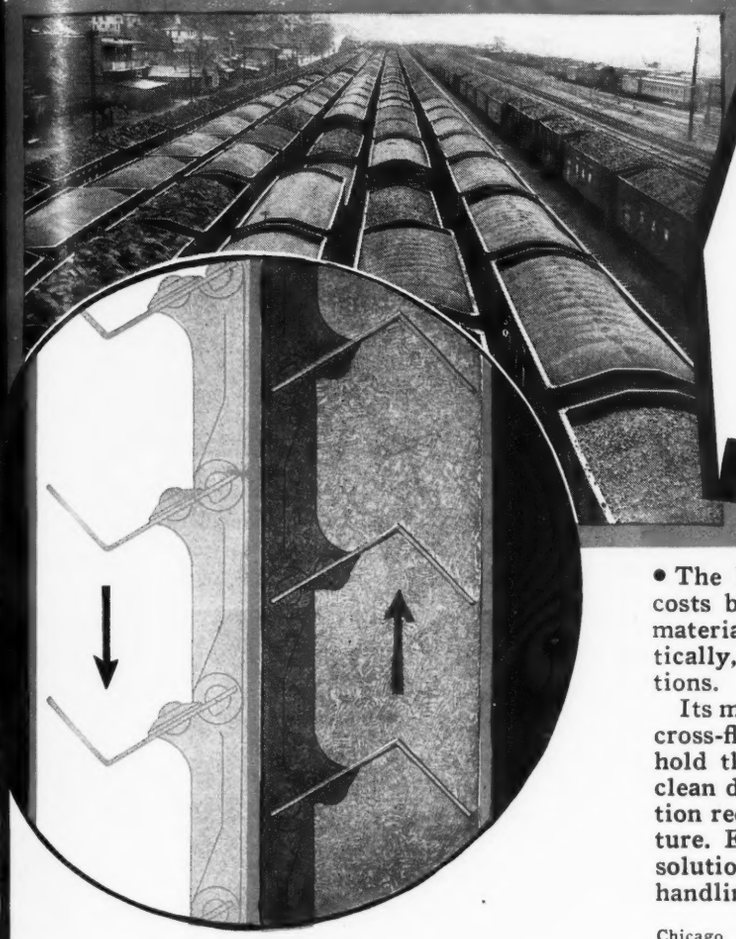


MOVES COAL and Other FLOWABLE MATERIALS in Compartments, Like an Endless Train

• The Link-Belt Bulk-Flo conveyor-elevator-feeder cuts handling costs by removing the limitations of alternate methods. It moves materials in compartments, like an endless train—horizontally, vertically, on slants of any degree, around corners, in many combinations.

Its moving element is a specially designed chain with peak-shaped cross-flights at each pitch, forming the series of compartments which hold the material. This design gives automatic feed . . . quick, clean discharge . . . smooth, reliable, low-cost operation. Installation requires much less space and you save also on supporting structure. Extreme flexibility of layout makes possible a simple, low-cost solution to what might otherwise be a complicated, expensive handling problem.

LINK-BELT COMPANY

Chicago • Philadelphia • Indianapolis • Atlanta • Dallas • San Francisco • Toronto
Offices, Warehouses, Distributors in Principal Cities

8818-D

Saves Space

Bulk-Flo is unusually compact, effecting a considerable saving in space requirements and supporting structure.

More Flexible

Bulk-Flo can be laid out to carry vertically, horizontally, around corners, along curves and on slants of any degree. Loading and discharge points can be located to suit. Tandem units can also be used.

Self-Feeding, Enclosed

Bulk-Flo is self-feeding to capacity from bins, hoppers and chutes. It cannot flood. Material is moved in a dust-tight casing. It operates under partial loading with as high efficiency as when fully loaded.

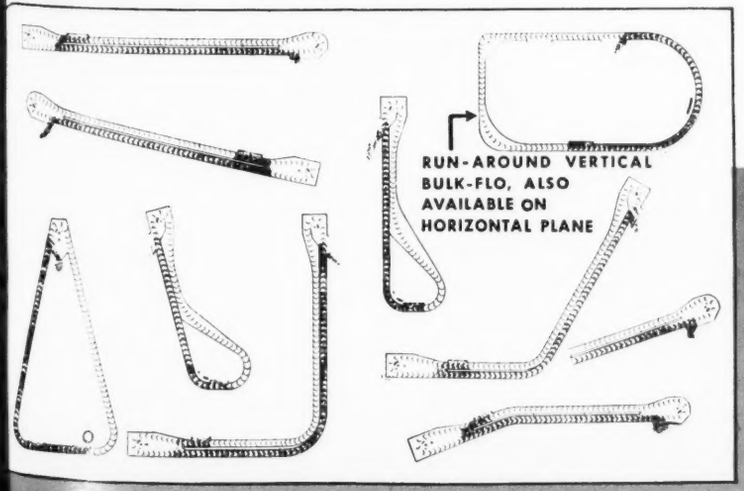
This Book Has Full Information

Book No. 2075 contains a complete presentation of Bulk-Flo with engineering tables and illustrations. Send for a copy.

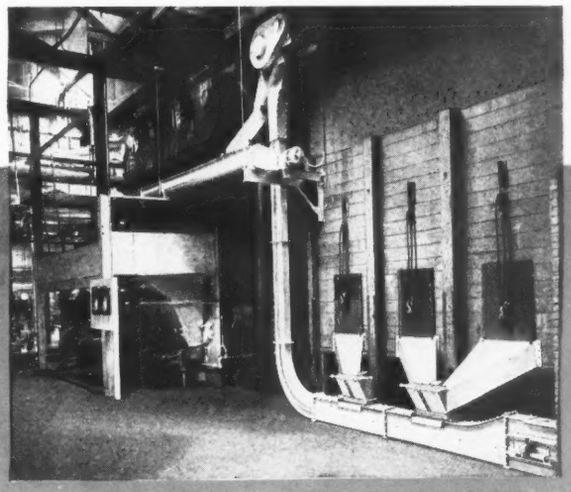
Slow Speed: Large Capacities

Because the material in a Bulk-Flo moves en masse, the speed is slow; usually 30 to 60 ft. per minute. Large capacities are obtainable by large duct cross section, rather than by speed.

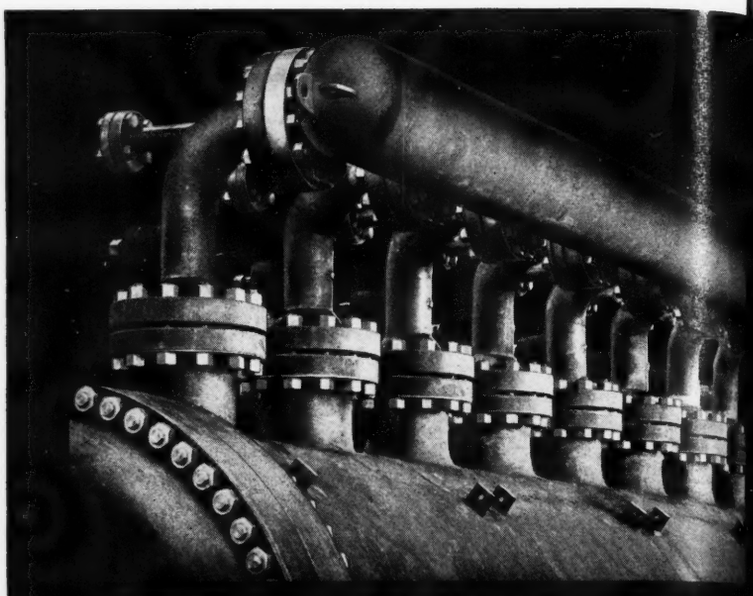
Below: Some of the many arrangements available with Bulk-Flo to provide simple, low-cost solutions to handling problems within its scope. Often tandem units are used to advantage.



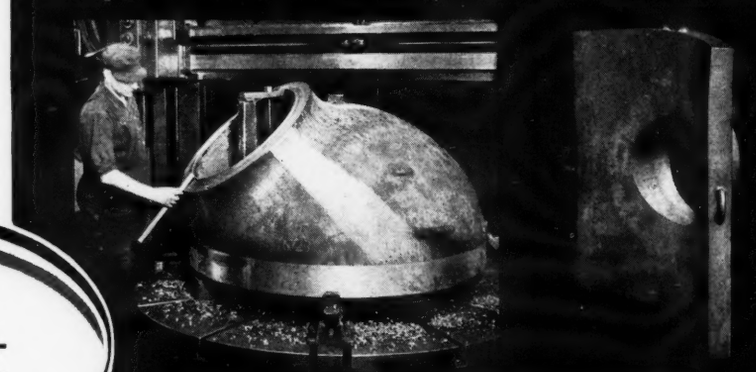
Below: An interesting application of Bulk-Flo conveyor-elevator-feeder to the handling of coal in a plant power house. The Bulk-Flo transfers coal from bins near floor level to a screw conveyor which distributes it to stoker hopper.



Consult B&W on all High-Temperature High-Pressure Problems



VESSELS FOR HIGH TEMPERATURE SERVICE
Illustration shows vessel with streamlined openings built of Croloy 2 plate for normal service at 100 lb. per sq. in. and 1050 F.



B&W STREAMLINED OPENINGS
All reinforcing forged and drawn from parent metal.

B&W designing skill and manufacturing experience are developing new and practical solutions for many problems encountered by chemical industries engaging in production of butadiene, styrene, toluol, 100-octane gasoline and other ingredients of victory.

B&W EQUIPMENT INCLUDES

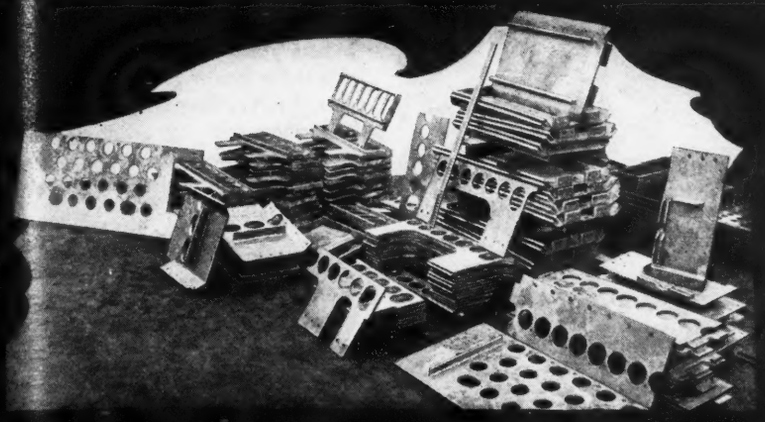
Catalyst cases for production of butadiene from both alcohol and butane;

Separately fired high-temperature and high-pressure superheaters for butadiene production;

Fired and waste-heat boilers for butadiene production;

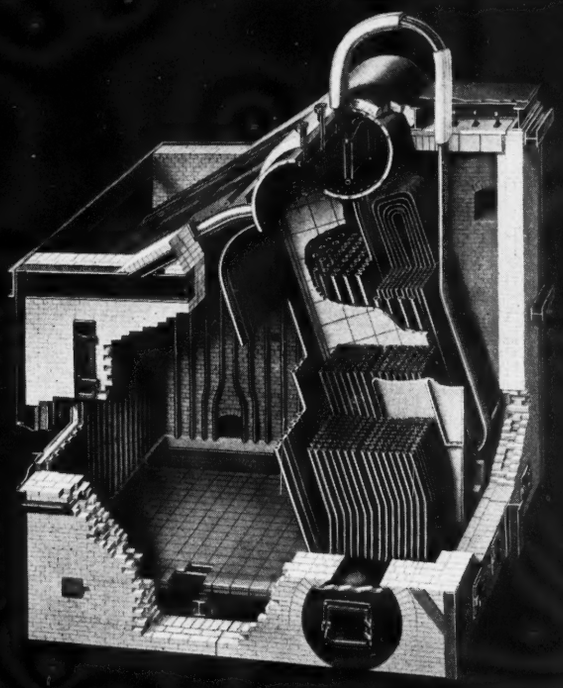
Alloy furnace castings for all processes;

Pressure vessels for all processes producing butadiene, toluol and high-octane gasoline.



B&W ALLOY TUBE SUPPORTS

More than two million pounds of Babcock & Wilcox Tube Support Castings in high-temperature furnaces have been supplied, and not a single service failure has been reported. Service temperatures range as high as 2000 F. under conditions requiring high creep strength, consistent with long-time stability. The castings include all types of supports, together with related links, bolts, nuts, etc.



B&W INTEGRAL FURNACE BOILERS

This type of boiler, a thoroughly coordinated unit of modern design, possesses advantages of especial value in chemical-industry installations. Installation requires minimum alteration of existing structures. A wide variety of fuels is permissible. Particularly notable for their simple, practical construction which makes them exceptionally easy to operate and maintain. *

★ ★ B&W PRODUCTS ★ ★

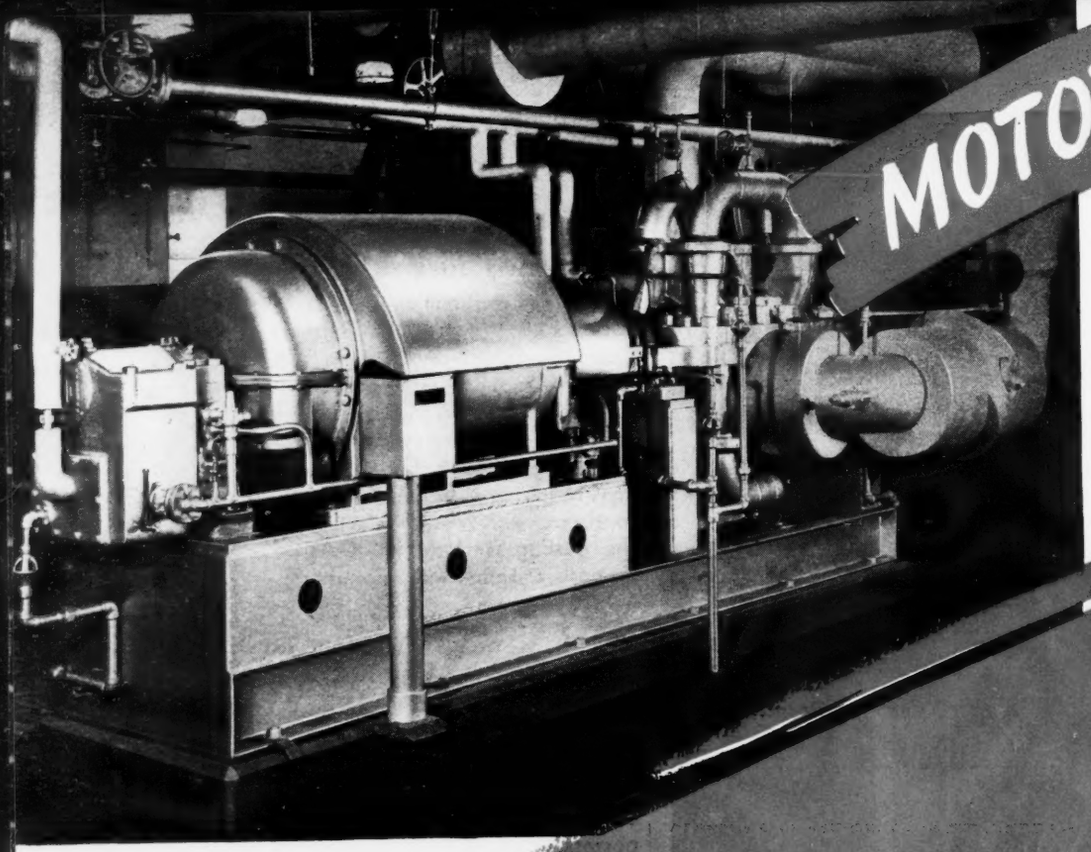
HELPING PRODUCE INGREDIENTS OF VICTORY!

BABCOCK & WILCOX

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK, N.Y.

* Complete details appear in Bulletin G-17-A, sent free on request.

S-30 T



MOTORS

When your conditions call for motor drives for boiler-feed pumps and other auxiliaries, investigate what Elliott Company has to offer. Large high-speed, two-pole induction motors, like the one shown in the picture at the left, are an Elliott specialty, resulting from 25 years of study, experiment, and research in Elliott shops. We are building many of these motors, in all sizes, for utility plants. They call them exceptionally good motors. Their construction includes special lubrication and

The drive to fit

is built by

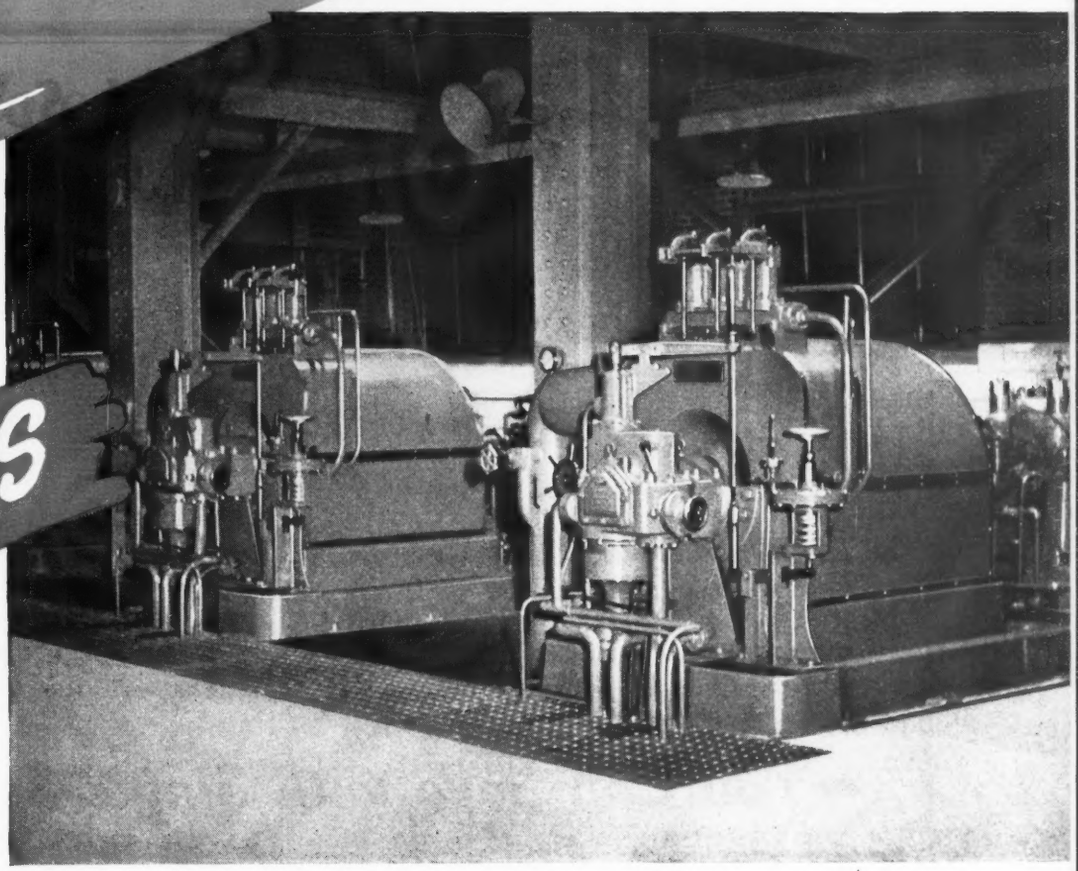
EL

ventilating features which add to reliability. Often the Elliott patented "Diamond Cage" construction is used to give high starting torque and, in the case of synchronous motors, high starting and pull-in torques.

Elliott Company makes all types of large motors, and designs motors for special applications.

your heat balance

TURBINES



When the heat balance calls for steam drive, or variable speed is important, Elliott turbines fit the picture. Elliott Company's line of mechanical drive turbines covers the complete range of sizes required by power plant auxiliaries; steam conditions up to 600 lb. gage and 750 deg. F.; gears, built-in or separate, when required; from small single-stage turbines up to large multi-stage, high-efficiency turbines, such as those illustrated at the right.

Elliott engineers know how to fit the turbine to your needs and conditions, and how to attain both high efficiency and maximum dependability. Ruggedness is a characteristic of Elliott turbines, both multi-stage and single-stage.

We also build all-Elliott turbine-generator units from small sizes to around 10,000 kw.

Should the type of drive be in doubt, we'll be glad to lend our experienced advice. Details on Elliott motors and turbines are available for the asking.

Q 1089

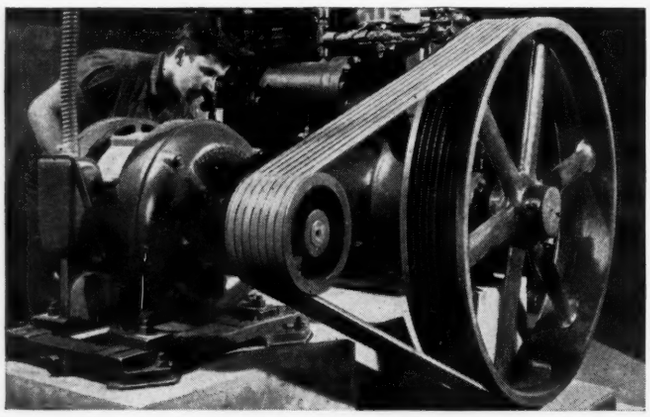
ELLIOTT COMPANY

JEANNETTE, PA.
RIDGWAY, PA.
SPRINGFIELD, OHIO

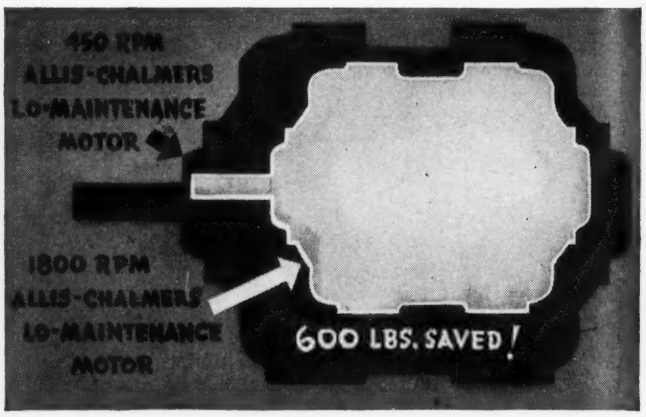
DISTRICT OFFICES IN PRINCIPAL CITIES

It's Time to Look at Motor

➔*You Can Save with High-Speed Instead of*

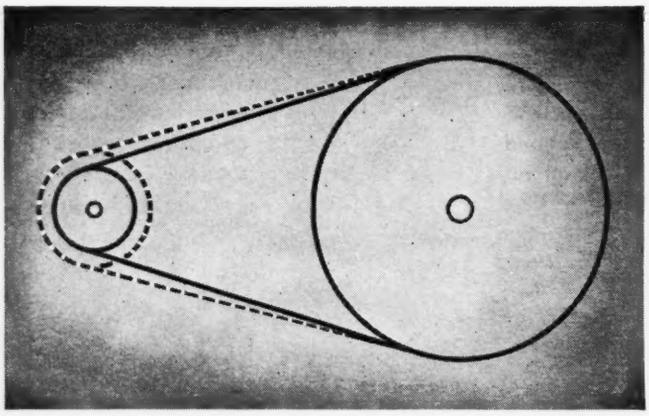


1. In most applications, an 1800 rpm motor with Texrope Drive will ably do the job of a lower-speed, direct-connected motor . . . *and* give you *exactly* the speed you want — *at lower cost!*

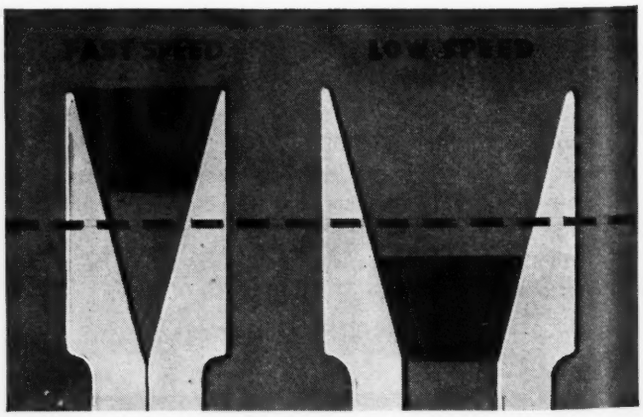


2. When you buy an 1800 rpm instead of 450 rpm 15 hp squirrel-cage motor, for example, 600 lb of critical materials are saved. And *you* save well over $200—with the drive figured in! This saving is typical.

➔*You Can Save with Single-Speed Instead of*



1. Infrequently needed speed changes can be had by changing from one size motor sheave to another. By juggling *complete* drives, speeds can be changed over the full range — from 1:1 to 7:1.

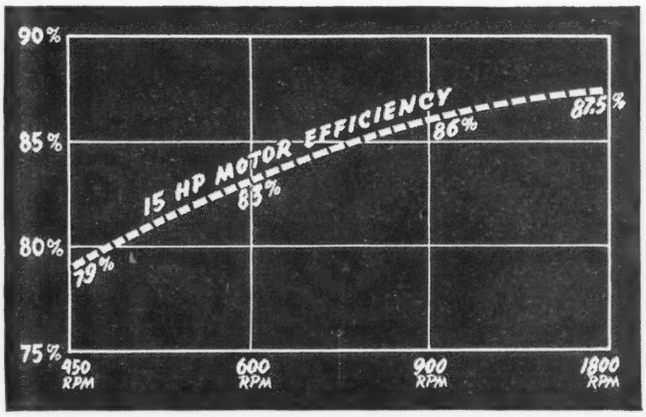


2. With the Allis-Chalmers Vari-Pitch Sheave, you can increase or decrease speed by adjusting sheave diameter, as above. Within limits, an unbroken series of speeds can be obtained.

Take a Fresh Buying!

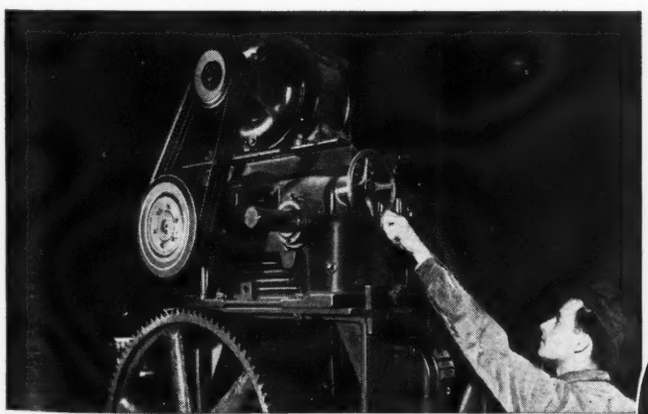
WAR FORCES HIGHER EFFICIENCIES...

Low-Speed Motors...



3. Note that efficiency rises from 79% for a 450 rpm motor to 87.5% for a 1800 rpm motor. Comparing power consumption, the 1800 rpm motor saves you over 30 kw/24 hr. day.

Multi-Speed Motors...



3. Allis-Chalmers Vari-Pitch Speed Changer gives you infinite changes at the turn of a wheel — within 3.75 to 1. It's the most compact, flexible variable-speed transmission available.

It was good business in peacetime to use — as widely as possible — high-speed motors with Allis-Chalmers Texrope Drives...and single-speed motors with Allis-Chalmers Vari-Pitch Sheaves and Speed-Changers. And it's clearer every day that those material and money-saving practices are *vital* practices in time of war!

TODAY the whole picture of buying and applying motors has changed. Note at the left how much you can save for your country *and yourself* with high and single-speed motors made flexible by Texrope Drives.

As America's only builder of both electric motors and V-belt drives,* Allis-Chalmers has long advocated the proper combining of motor and V-belt drive.

And today you benefit from Allis-Chalmers' vast, pioneering experience in this field when you ask for and get the *right* combination of Lo-Maintenance Motor and Texrope Drive! Call your nearby district office. Or write ALLIS-CHALMERS MFG. CO. MILWAUKEE, WISCONSIN.

A 1560

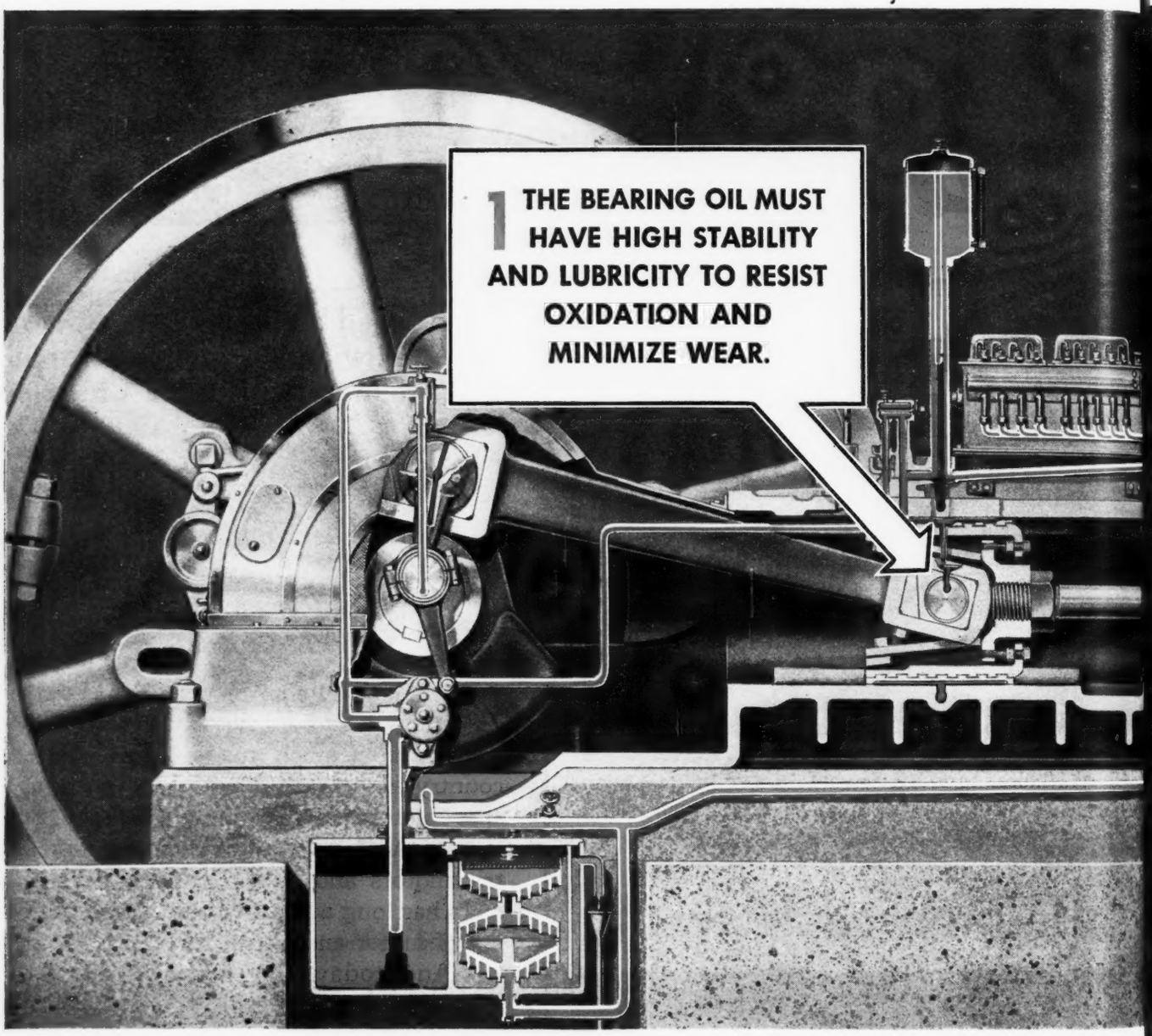
*Allis-Chalmers *originated* the Multiple V-Belt Drive and Vari-Pitch Sheaves.

ALLIS-CHALMERS A-C MILWAUKEE

WE WORK FOR VICTORY

WE PLAN FOR PEACE

Fighting a "2-Front" War



A "CORRECT" ANSWER TO CYLINDER AND BEARING LUBRICATION NEEDS OF RECIPROCATING STEAM ENGINES:

Problem: An engineer is faced with a double lubrication problem in preventing "trouble" in steam engine operation:

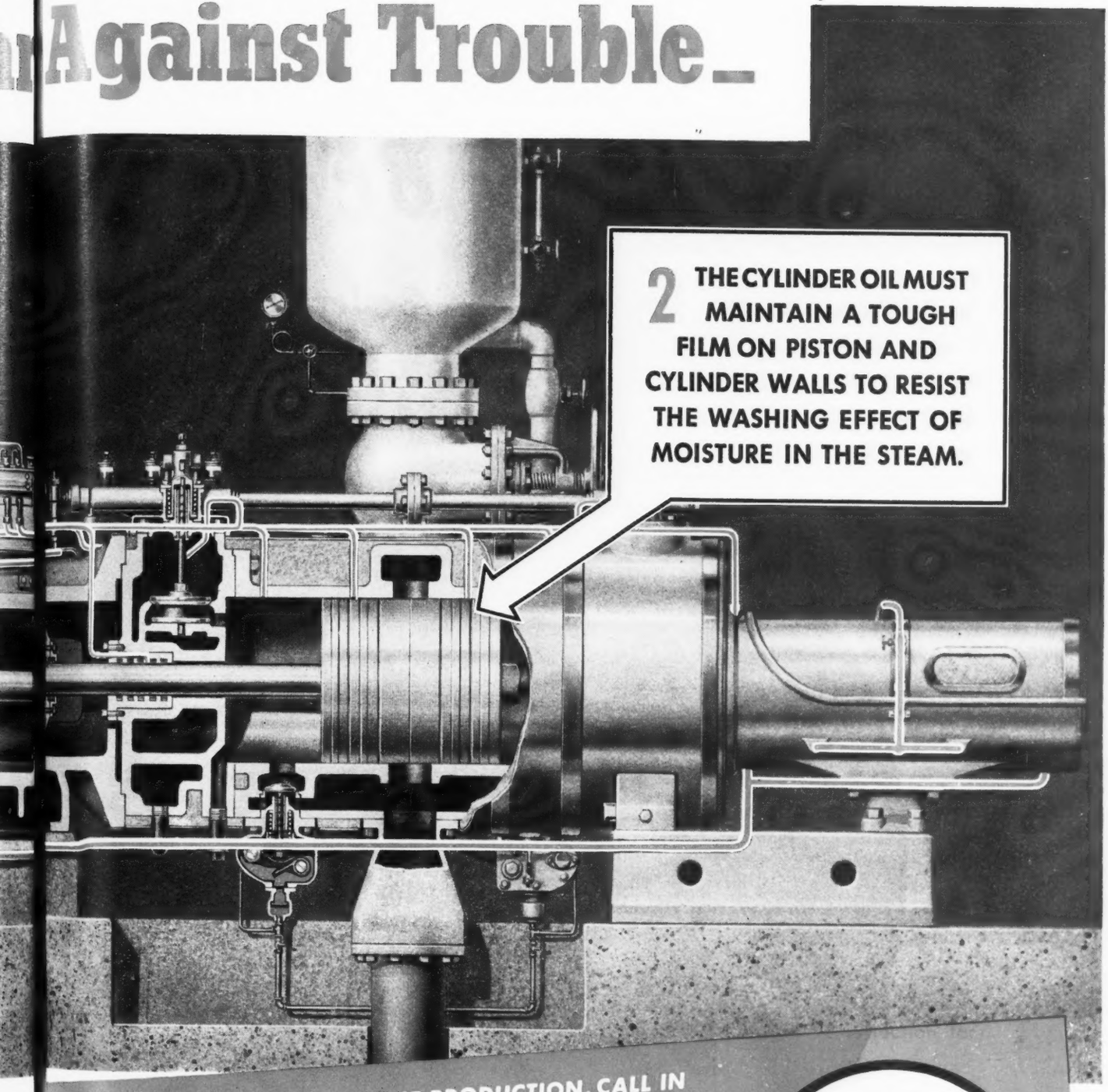
1. *In the bearings,* oil is supplied by a circulation system. That oil must have high stability and lubricity to resist oxidation and minimize wear.

2. *In the cylinder,* oil must be fed in restricted feeds to minimize the amount carried to the boiler feed water. The oil must maintain a tough film on the piston and cylinder walls. That film must resist the washing effect of moisture in the steam.

Answer: For correct cylinder lubrication, *Gargoyle Cylinder Oils* are unsurpassed in their combination of film strength and special adhesive properties in the presence of water.

For bearing lubrication, *Gargoyle D. T. E. Oils* have the high stability and lubrication properties needed to assure long, trouble-free bearing life.

Against Trouble_


2 THE CYLINDER OIL MUST MAINTAIN A TOUGH FILM ON PISTON AND CYLINDER WALLS TO RESIST THE WASHING EFFECT OF MOISTURE IN THE STEAM.

TO HELP MAINTAIN WARTIME PRODUCTION, CALL IN

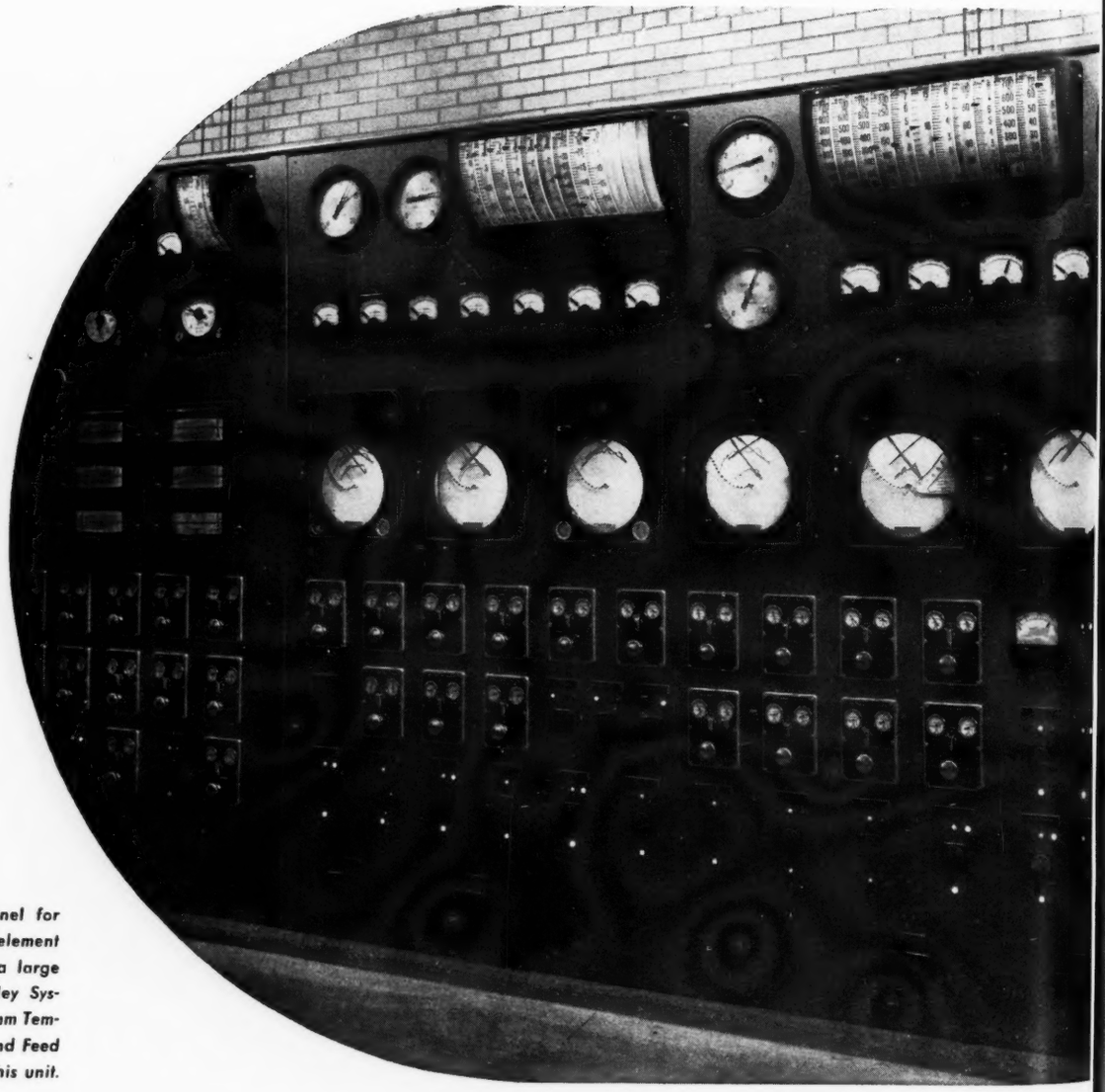
SOCONY-VACUUM for "Correct Lubrication"

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC. — Standard Oil of N. Y. Div. — White Star Div. Lubrite Div. — Chicago Div. — White Eagle Div. — Wadhams Div. — Southeastern Div. (Baltimore) — Magnolia Petroleum Company — General Petroleum Corporation of Calif.

"AN OUNCE OF IS BETTER

Boilers, Furnaces, to-Replace Units



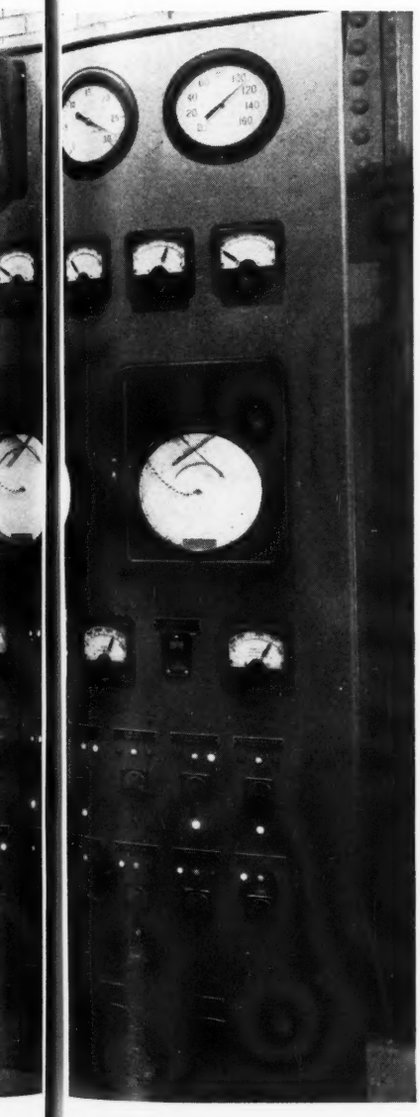
Bailey Meter Control Panel for Combustion and Three-element Feed Water Control on a large Power Boiler. Other Bailey Systems for the control of Steam Temperature, Heater Levels and Feed Water Pumps also serve this unit.

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

PREVENTION - - - "

Superheaters, Turbines, Pumps and other Hard- Can Be Protected by *Bailey Meter Control*



★ Before the battle of production, an outage of a power unit usually had little effect on productive capacity, replacement parts could be quickly secured, and experienced maintenance men were available. Now all this is changed and the power engineer must try harder than ever to avoid the always costly shut down for repair.

Bailey Meter Control is an effective defense against many of the causes for such shut downs, such as:

1. Destructively high furnace temperatures.
2. Dangerously low or high water levels.
3. Excessive steam temperatures.
4. Insufficient flow through boiler feed pumps and superheaters.
5. Loss of ignition in the furnace.
6. Explosive mixtures of fuel and air.
7. Unsafe operating sequences.

Even with inexperienced operators, Bailey Meter Control enables the power engineer to secure continuity of operation, together with fuel conservation and protection for both personnel and equipment.

If your plant is engaged in War Production, we suggest that you investigate fully the possibilities of preventive maintenance made possible by Bailey Meter Control.

BAILEY METER COMPANY

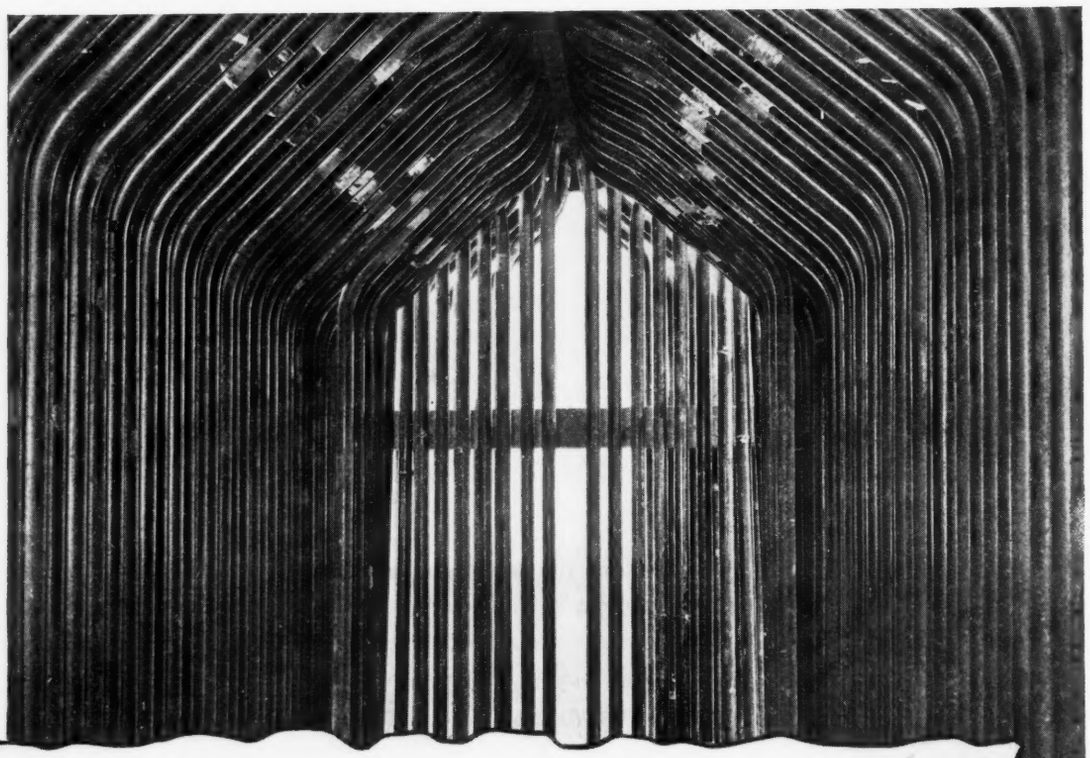
1036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

BAILEY METERS

. . . *The Complete Boiler Control System*

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL



Typical "S-A" boiler furnace within the tube bank.

FUEL AND STEEL SAVED IN "S-A" BOILERS

● The single welded drum "S-A" boiler, designed for maximum steam from minimum critical materials, meets war priority requirements.

Although using but one welded drum it provides the design and performance advantages of high efficiency, bent tube, water-cooled furnace steam generators. The small requirement for restricted materials and drum welding offers promptest delivery to manufacturers holding adequate priority ratings.

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK, N. Y.

FOSTER WHEELER

Helpful Information on the Use of HAYNES STELLITE HARD-FACING MATERIALS

MATERIAL	PHYSICAL PROPERTIES	PURPOSES FOR WHICH USED	TECHNIQUE POINTERS FOR APPLICATION	METALS THAT CAN BE SURFACED
HAYNES STELLITE ALLOY No. 1	–red hardness –high abrasion resistance –low coefficient of friction –good corrosion resistance –tensile strength–47,000 lb. per sq. in. –hardness–Rockwell C-54 –coefficient of expansion–similar to steel –hardest of the three grades and most resistant to abrasion.	–For coating surfaces subjected to severe abrasive wear and only slight shock or impact.	***For Steel*** –Remove all rust or scale from surface. –Preheat part to be coated if necessary. –Adjust flame so there is an excess of acetylene. The excess acetylene "feather" should be twice as long as the inner cone. –Bring small surface of base metal to a "sweating" condition, insert end of rod into flame and let rod melt and spread over "sweating" area. –Continue applying until entire surface to be faced is built up to required depth. Do not puddle. ***For Cast Iron*** –Similar to steel except use slightly less excess of acetylene. It is necessary to break up the surface "crust" with end of rod. "Ferro" flux facilitates this operation and is recommended if base metal is dirty.	***Carbon Steels*** up to 0.60 per cent carbon ***High-Carbon Steels*** above 0.60 per cent carbon if properly heat-treated before and after ***Low-Alloy Steels*** heat-treatment may be necessary ***High-Speed Steel*** not recommended ***Manganese Steel*** use electric welding only ***Stainless Steels*** heat-treatment is necessary ***Cast Iron*** easily hard-faced ***Chilled Iron*** on small parts only ***Alloy Cast Iron*** same technique as for gray cast iron ***Monel Metal*** easily hard-faced ***Brass and Bronze*** not recommended ***Copper*** not easy to do ***Aluminum*** cannot be hard-faced ***Hascrome Rod Deposit*** easily faced ***Nitrided Steel*** grind off case before hard-facing
HAYNES STELLITE ALLOY No. 6	–red hardness –high abrasion resistance –low coefficient of friction –good corrosion resistance –tensile strength–105,000 lb. per sq. in. –hardness–Rockwell C-40 –coefficient of expansion–similar to steel –not as hard as, but tougher than, No. 1 or No. 12. Resistance to abrasion slightly less than No. 12. Does not check easily.	–For coating surfaces subjected to abrasive wear accompanied by considerable impact. Also recommended for cutting edges of hot-work dies. Also for valves of all kinds.		
HAYNES STELLITE ALLOY No. 12	–red hardness –high abrasion resistance –low coefficient of friction –good corrosion resistance –tensile strength–76,000 lb. per sq. in. –hardness–Rockwell C-48 –coefficient of expansion–similar to steel –not quite as hard as No. 1 and slightly less abrasion resistant. Stronger and more ductile; more resistant to impact.	–For coating surfaces subjected to severe wear with enough impact to require more toughness than is possessed by No. 1.		
HAYNES STELLITE "93" ALLOY	–high cold hardness –high abrasion resistance –moderate impact resistance –tensile strength–43,040 lb. per sq. in. –hardness–Rockwell C-62 –coefficient of expansion–similar to steel	–For applications where high cold hardness is necessary and corrosion is not an important factor.	–Use flame half way between that for Hascrome rod and that for Haynes Stellite rod. –Applied like Haynes Stellite rod except that mild puddling is permissible on dirty surfaces or for obtaining an extra smooth surface.	
HASCROME ROD	–self-hardening –work-hardening –good abrasion resistance –high impact resistance –tensile strength–40,000 lb. per sq. in. –hardness–Brinell 240 to 500 as deposited depending on application technique. –tougher than Haynes Stellite alloys but not as resistant to abrasion.	–For surfaces subjected to abrasive wear and severe impact. –Makes a very good base for subsequent coating of Haynes Stellite alloys because it resists the mushrooming effect of impact.	–A flame adjustment half way between neutral and that for Haynes Stellite rod is best. –Base metal should be at a "sweating" heat. –Do not puddle. –Use "Ferro" flux if base metal is dirty.	***Manganese Steel*** use electric welding only ***Carbon Steels*** easily applied ***Low Alloy Steels*** heat-treatment may be necessary both before and after ***Alloy Castings*** consider heat-treatment ***Gray Cast Iron*** easily applied
HAYSTELLITE TUBE ROD	–various screen sizes of sharp, irregularly shaped grains contained in tubes of High Test Steel –easily applied by welding flame.	–Where utmost resistance to abrasion is necessary, such as for coating oil well drilling tools.	–Applied in manner similar to other hard-facing rods avoiding deep puddling but obtaining enough penetration to make strongest bond between base metal and binding material.	Same as Haynes Stellite alloys

Send for the free wall chart, "Hard-Facing Materials Data." It includes the above information and other helpful data.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

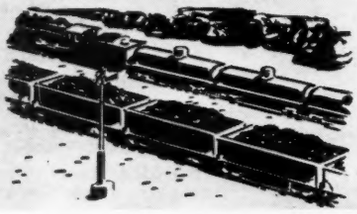
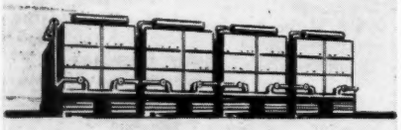
New York, N. Y. UCC Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

The words "Haynes Stellite," "Hascrome," and "Haystellite" are registered trademarks of Haynes Stellite Company.

First Aid Chart

	WAR CONDITIONS	POWER PROBLEMS
Manpower	Skilled operators being called for military service. Fewer experienced operators available for replacement. Inexperienced men to be trained.	Power plants must be operated at maximum capacity and efficiency with fewer skilled operators who, at the same time, must aid in the training of new and inexperienced men.
Fuel 	Transportation difficulties threaten curtailment of fuel shipments causing temporary fuel shortages.	Emergency fuel must be obtained and stored. Available fuel must be burned at maximum efficiency to stretch present supply and to minimize haulage. Must be prepared to burn a substitute fuel if necessary.
Steam 	Big increase in steam demand. Lack of generating capacity. New steam generating equipment hard to get even with good priorities.	Every possible pound of steam must be squeezed from present generating units to meet new load demand. Process steam waste must be checked and held to a minimum.
Maintenance	All equipment operating at overload. No stand-by equipment. Replacement parts difficult to obtain. Inexperienced operators.	Maintenance and repairs must be taken care of promptly, in spite of a shortage of experienced maintenance men or difficulties in getting materials, in order to avoid major shut-downs.

REPUBLIC
INSTRUMENTS
AND CONTROLS

FOR SOLVING WARTIME POWER PLANT PROBLEMS

THROUGH the use of instruments and controls you may be able to increase your steam supply just enough to get it over the peak. Republic engineers will be glad to consult with you. Write to us today.

INSTRUMENTS	BOILER CONTROLS	PROCESS CONTROLS
IMPROVE SUPERVISION Instruments provide operators with continuous indications of operating conditions. Permit centralized supervision of all operating factors. Provide continuous record of performance.	**CONSERVE MANPOWER** Automatic boiler controls, by performing the routine repetitive adjustments, free the operators for more important supervisory duties.	**STRETCH SKILL** Automatically perform routine repetitive adjustments to maintain desired conditions thereby enabling the operator to surpervise the operation of a larger number of units.
CHECK LOSSES CO_2 meters, draft gages and flue gas temperature recorders provide a continuous check on combustion efficiency and preventable heat losses. Steam meters serve as a guide for the proper load distribution among boilers.	**SAVE FUEL** Automatically maintain highest combustion efficiency by controlling fuel and air input, in a fixed predetermined ratio, over the normal load range. Provide for changes in fuel characteristics and other operating factors.	**REDUCE WASTE** For every pound of steam wasted and for each extra gallon of watar pumped, etc., a corresponding amount of fuel had to be consumed in the boiler room. Automatic controls reduce power waste and thereby save fuel.
CHECK STEAM WASTE Meters installed on main distribution lines will immediately center attention on the department or unit using excessive amounts of steam. They provide the information needed to coordinate steam consumption with steam production.	**TEST EFFICIENCY** Produce maximum steam output at test efficiency by maintaining constant steam pressure, maximum combustion efficiency, constant and correct furnace draft and desired load division among boilers.	**MORE STEAM** By reducing the power consumption of pumps, compressors, dryers or other steam consuming units, through the use of automatic controls, you increase the effective capacity of your power plant.
LOCATE TROUBLE SPOTS Instruments, by providing a check on the performance of various units, are invaluable in spotting potential trouble spots before they develop to a point where they require extensive repairs and interfere with production.	**REDUCE OUTAGES** Correct boiler operation reduces outages. Boiler controls, by coordinating all operating factors, prevent the chain-of-events type of trouble that may lead to serious shut-downs.	**UNIFORM PERFORMANCE** Maintain correct process conditions under continuous operation at peak capacity. When both operators and equipment are working at capacity close control is vital to prevent serious maintenance outages.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

FIND METAL-CUTTING HORSEPOWER *Quickly* WITH THE

1 **JUST SET THE MOTORULE SCALE**

2 **READ OFF NEEDED CUTTING POWER* HERE**

This newly developed load calculator makes it easy to figure the motor horsepower required for metal-cutting operations when the recommendations of the machine builder are unavailable. Its advantages? You can avoid *undermotoring* and save yourself production delays; you can avoid *overmotoring* and save the nation vitally needed steel, copper, and aluminum.

The G-E MOTORULE is accurate for a wide variety of cutting operations on lathes, drills, milling machines, and planers. It works on a wide range of materials, because you start from a convenient table of constants for the particular type of metal being cut.

The results of many years of work by metal-cutting authorities were used by G-E engineers as a basis for the MOTORULE. The formulas were checked against actual load tests, and leading machine-tool builders were consulted.

The MOTORULE will help you in making sure of adequate motor capacity on machines being put to new war work, and in selecting motors for machines formerly driven from line shafting. And, wherever machines are used for a variety of jobs, the MOTORULE provides a quick way to determine where machine production can be increased. To get your MOTORULE, just get in touch with your G-E Motor Representative. Or, if you wish, mail coupon direct to General Electric, Schenectady, N. Y.

* Naturally, the MOTORULE is not intended to supplant the instructions of machine builders as to the power requirements of their machines. Rather, it is offered to fill the gap when these recommendations are unavailable, or when new war work has altered the load conditions.

General Electric Co., Sec. D 750-144
Schenectady, N. Y.

☐ Please send me a G-E MOTORULE, with full instructions and leaflet giving the principles on which it is based.

☐ Please send your MOTOR FITNESS MANUAL, GED-1017.

Name..... Title.....

Company.....

Street.....

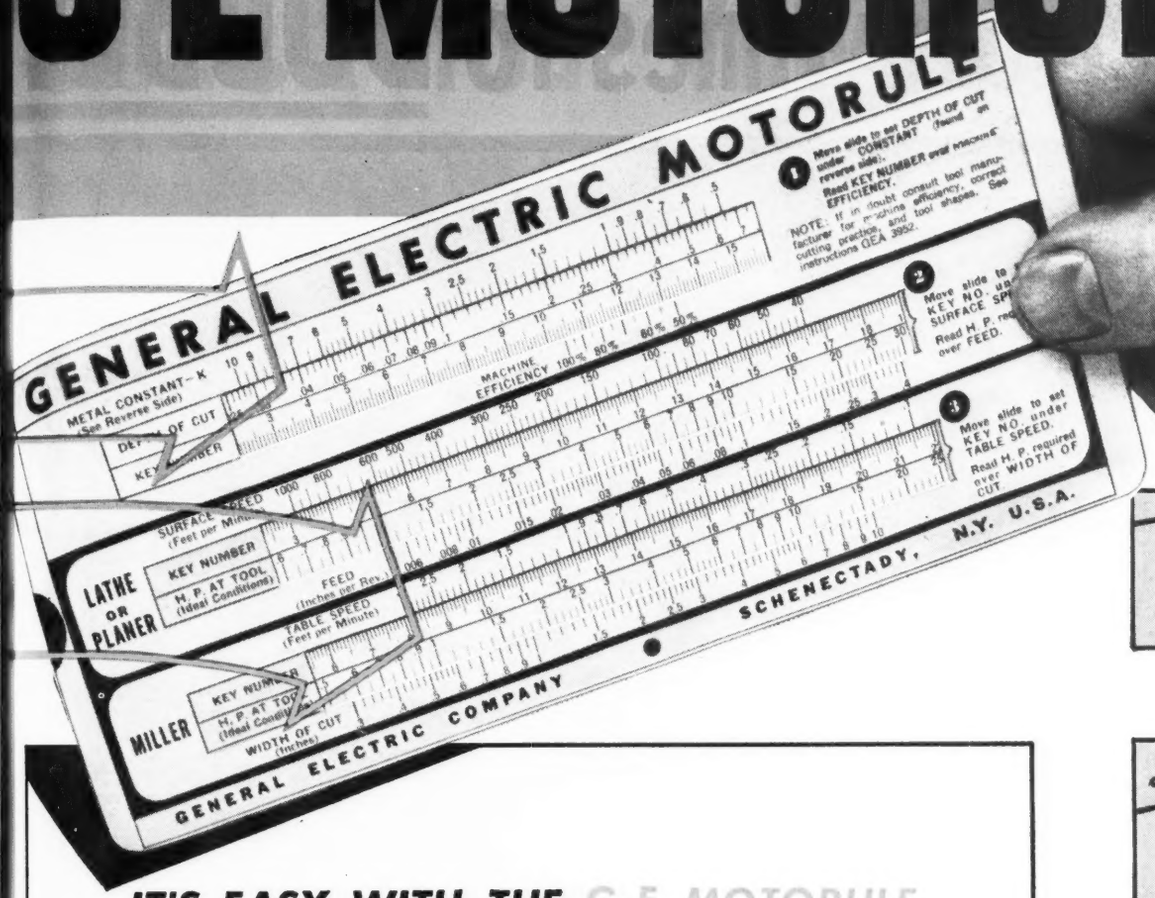
City..... State.....

8030

MOTOR FITNESS MANUAL—tells what to do to get the most out of motors, old or new; gives practical suggestions for selection, application, maintenance. Check coupon for a copy of this up-to-the-minute booklet.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment

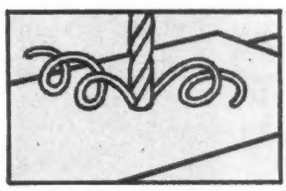
G-E MOTORULE!



IT'S EASY WITH THE G-E MOTORULE

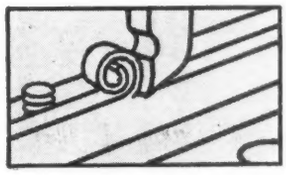
First you refer to a convenient table of constants, printed on each rule, choosing the constant for the particular type of metal to be cut. Then, by setting adjacent scales to the known cutting speed, feed, and cut, you arrive at the cutting power required on the basis of ideal tool and machine conditions. Complete instructions are furnished with each MOTORULE.

FOR LATHES



FOR DRILLS

FOR MILLING MACHINES



FOR PLANERS

SPECIFY TRI-CLAD MOTORS

STANDARD G-E MOTORS ARE GENERALLY AVAILABLE WITHOUT DELAY FOR WAR JOBS

GENERAL ELECTRIC

These are Times to DOUBLE-C

Proper care of valves begins with their purchase – meaning, that it pays in the end to buy good valves first.

But proper care doesn't end there . . . even the best valves need looking after, and prompt servicing, when necessary, will save more costly repairs and replacements later.

And these days, when it isn't easy to get new valves, and those you now have must do double and triple duty, it's just good business to do a little extra checking and inspecting of this vital equipment.

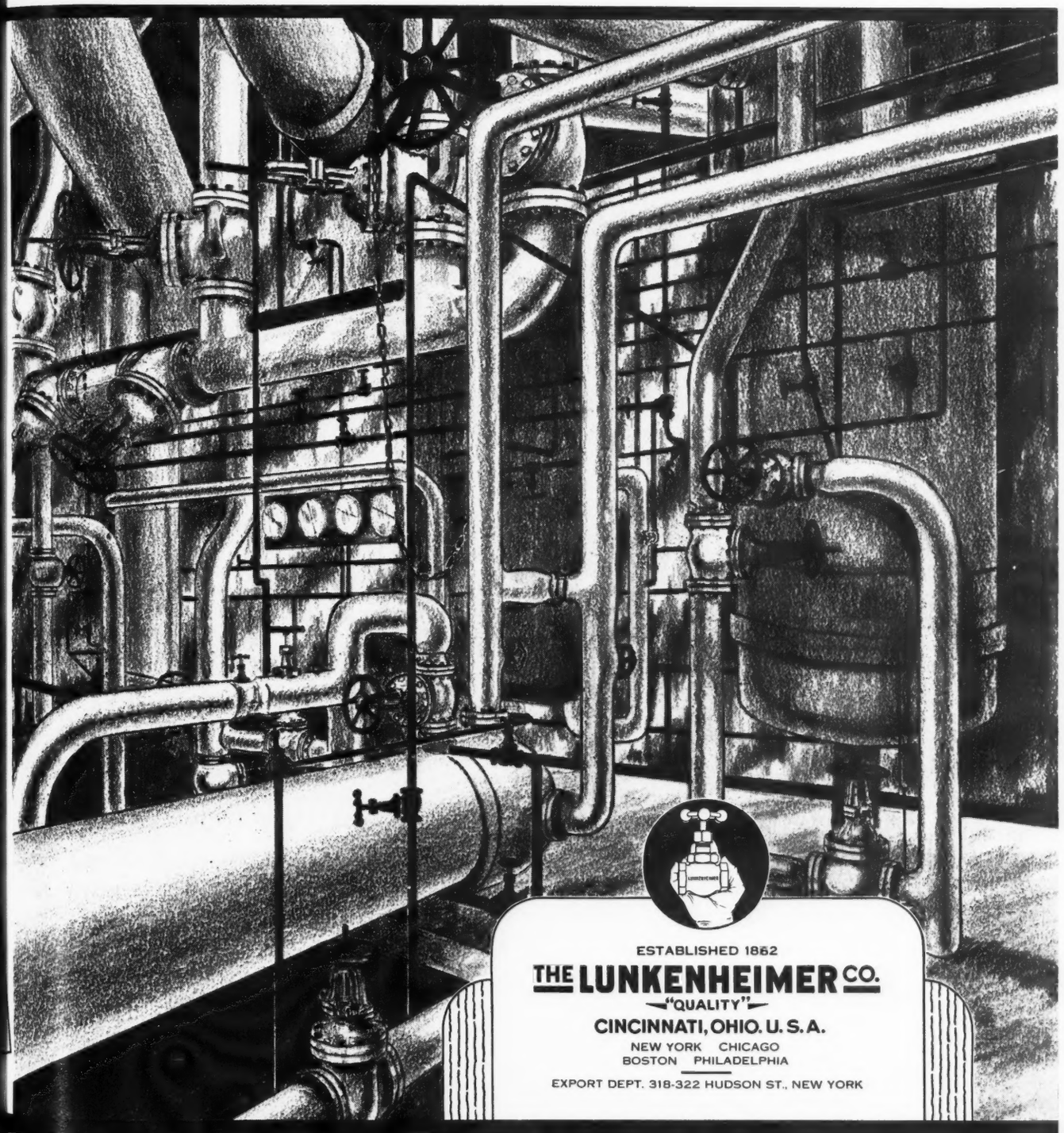
In the interest of uninterrupted production and the preserving of critical materials, Lunkenheimer urges every valve user to take extra special care of the valves he now has in service. They'll respond to good treatment and repay you in better service, less time out for repairs, and a minimum expenditure for maintenance.

●

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" symbols on their orders. This will be of mutual helpfulness.

LUNKENHEIMER

E-CHECK Your Valves ✓✓



ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

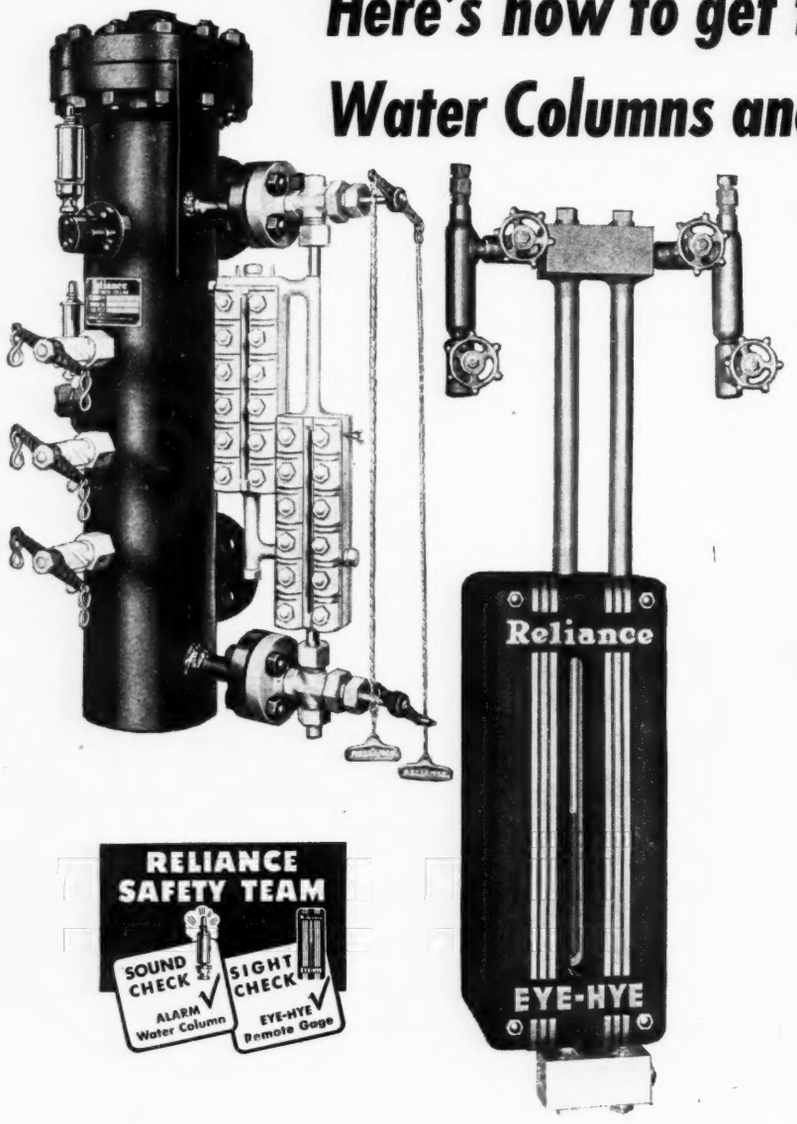
RVALVES

BOILER MOUNTINGS
LUBRICATING DEVICES

No. 28-103-42

More Power to You

Here's how to get the best service from Water Columns and Gages...to protect vital boilers through adequate water-level supervision



MAINTENANCE SCHEDULES should cover boiler water level indicating equipment as thoroughly as any other vital operating devices. It will pay you to review these points of good boiler room practice.

THE RELIANCE GAUGE COLUMN CO.
5902 Carnegie Avenue • Cleveland, Ohio
Representatives in Principal Cities to Serve You

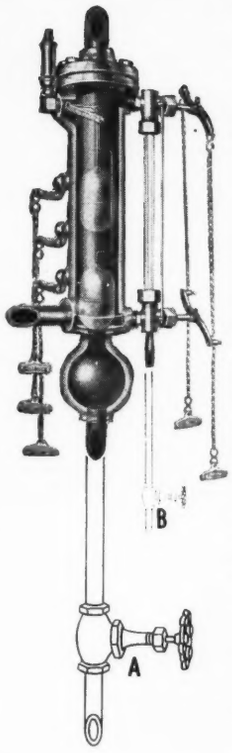
Since 1884

Reliance

BOILER SAFETY DEVICES

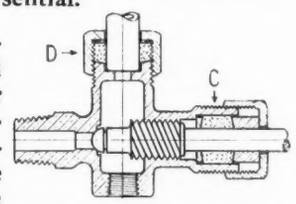
CHECK CHART

For Boiler Water Level Safety Devices



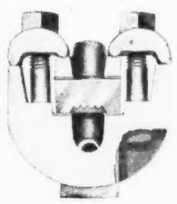
Water Column. Open blowdown valve (A) at start of each shift to flush sediment from column and to test low water alarm signal. *Open and close valve slowly to avoid water shock.* When operating conditions permit, raise boiler water level sufficiently to test high alarm signal, to insure constant readiness for emergency warning.

Gage Valves. Open blowdown valve (B) at start of each shift to remove sediment. Observe speed at which water returns to proper level. This indicates whether gage valve ports are unobstructed. Keep packing tight around valve stem (C) and glass (D)—leakage wastes steam and causes dirty deposits that not only look bad but hinder operation when quick action is essential.



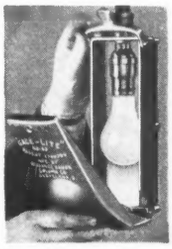
Gage Glass. Cleanliness is vital to good vision. Whether you are using tubular glass or an expensive insert, the glass must be *clean* for accurate reading. You know from experience how long a tubular glass may be used on your boilers before it is thinned to the danger point. Change glasses regularly. Also be sure tubular glasses have guards to prevent personal injuries from bursting glass.

Gage Glass Inserts. Prismatic and Flat Glass Water Gage Inserts, if used, should be inspected frequently for possible leakage. Expansion and contraction from temperature changes may loosen bolting pressure. A slight "take up" on insert clamping bolts may prevent blowing out of gaskets and reduce glass erosion.



Mica. Whether used as a protective coating to prevent glass erosion or as an insert window, treat mica with *utmost care.* All mica for this service is imported and replacement stocks definitely limited. When possible, mica should be cleaned with alcohol or other solvent and replaced in service. Otherwise salvage all mica possible by "splitting" and rebuilding to proper thickness with replacement sheets.

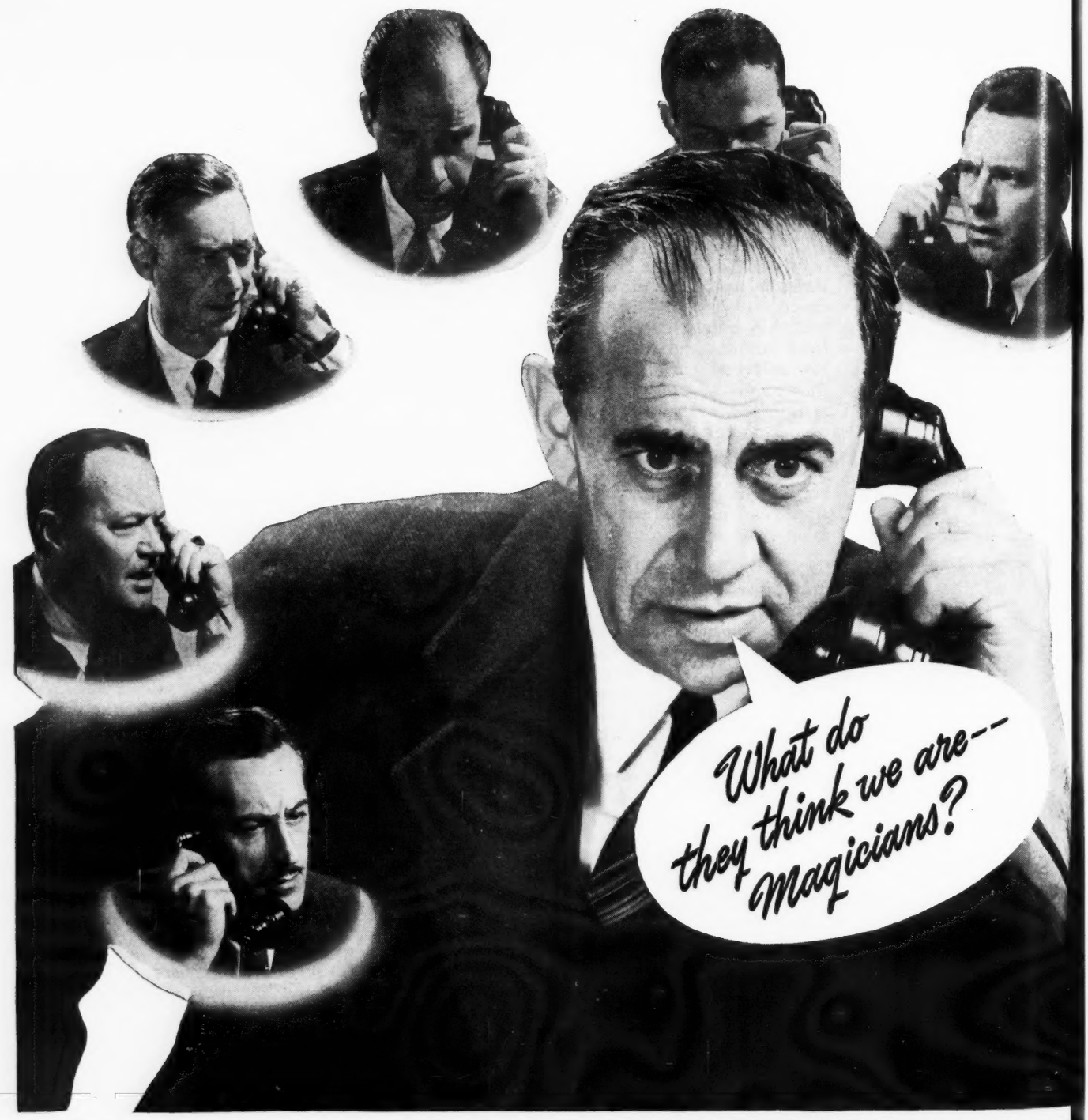
Illumination Equipment. Keep reasonably clean at all times to insure full visibility. Use proper size lamp. Most illuminators are constructed to focus maximum light rays from a definite location of lamp filament. Where mirrors are employed, check cleanliness and adjustment regularly.



Gage Cocks. Test daily to insure readiness for emergency operation. Frequent testing causes less wear than occasional use because sediment is not allowed to accumulate in quantity. Never leave a gage cock "sizzling"—open it for blowdown two or three times if necessary to remove the scale which may cause wire drawing and an early repair job.

Remote Reading Indicators. Familiarize yourself thoroughly with the manufacturer's instructions for proper care and follow them in detail. Don't let an indicator remain in service which may be inaccurate. Hang a warning sign on it until it can be serviced—*remember the man on the next shift!*

Checking procedure suggested by the Reliance Gauge Column Co.



MORE STEAM? Here is what you get with Hagan Automatic Combustion Control

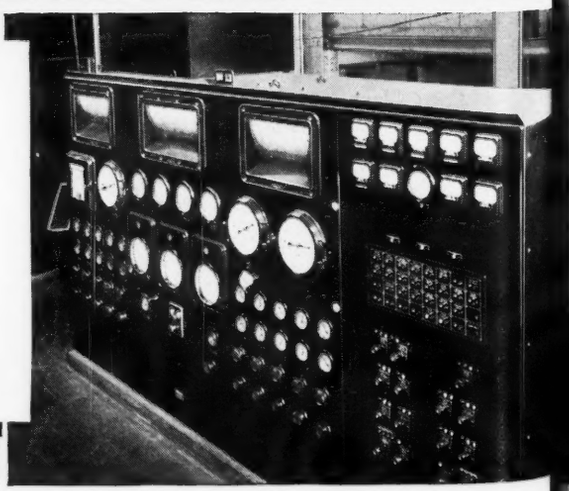
MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM UTILIZATION value, uniform steam pressure and temperature, in accordance with demand.

MAXIMUM OUTPUT from boilers of differing capacities, automatically.

MAXIMUM STEAM for production, by reducing loss of steam in frequent soot-blowing.

MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.



WHEN HEADQUARTERS KEEPS CALLING FOR MORE STEAM

IF you are doing everything you know how to step up the efficiency of your boilers and still fail to get a maximum output of steam, something is definitely lacking.

That "something" has proved in thousands of cases to be nothing more or less than *adequate* combustion control.

Because, regardless of other means employed to increase boiler capacity, Hagan Control, by adjusting all auxiliaries for maximum output, will insure the maximum of steam from every pound of fuel.

This is due to design superiority—rigid adherence to the sound principles pioneered by Hagan. If Hagan owes its wide acceptance by the power leaders of industry to any one thing, it is to the performance standards which are like law itself to Hagan engineers.

Every Hagan owner places complete reliance on the "mechanical brain" of the Hagan Control System. He knows it is never off the job—that it will do the work for which it was made with matchless, instantaneous precision.

Maybe you never have seen a plant operate under control like that. Maybe you didn't think it possible you could have such freedom from operating worries, such assurance of maximum results.

Then you should talk with a Hagan Combustion Specialist because he has the answers.

There is still time, fortunately. It is not too late to join the ranks of wartime producers who "when headquarters call for *more* steam" know they'll be able to produce it. Write, phone or wire for complete information about Hagan Control.

HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

"A" This automatic planimeter pen record shows steam flow in volume units and the time at which it was produced or used in any part of the 24 hour period, enabling you to easily analyze steam production and distribution.

"B" This record line shows rate of flow and enables the operators to maintain the most efficient boiler operation, thus effecting substantial fuel savings.

BROWN

Totals flow as a cash register totals dollars

am IS money. Wasting steam boosts overhead—eats up income—shrinks fits. Steam accounting is serious business—it needs business methods.

a modern cash register guards a storekeeper's dollars—producing a printed ord of each transaction—so flow meters should guard your power and process am.

th Brown Flow Meters measuring the flow of fluids for power, heating and cessing, you are completely protected — because The Brown Automatic cording Planimeter Pen, "A", making the marginal record shown on the chart tured supplies the PROOF that a definite number of pounds of steam, gallons water, cubic feet of gas, or barrels of oil, were delivered, utilized—or wasted.

s is a special, patented feature of the greatest value to flow meter users. ference to the automatic planimeter pen record on chart rim assists you to tribute departmental or process loads more uniformly over the working day, ecting substantial fuel savings not only in the boiler room but in every depart- nt or unit where steam is used.

addition, Brown Flow Meters offer you other advantages such as:

Six inter-related range tubes with inter-related direct reading charts.

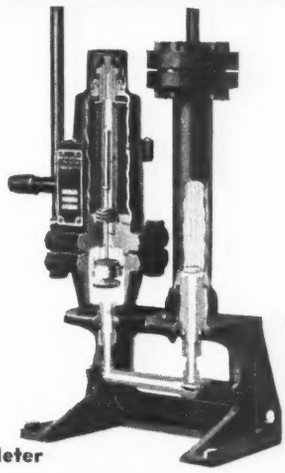
Meter Bodies for working pressures up to 2500 lbs.

Integrator dial—easy to read—insures highly accurate totalizing at all rates of flow from 0-100%.

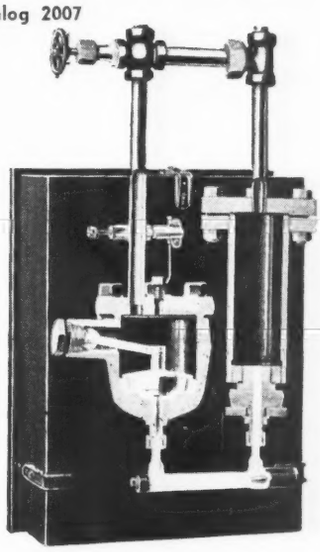
Universal case permits any style panel mounting—flush on panel, front-of-board or on wall.

Indicating, Recording and Controlling models—Electrical, Mechanical and Area types for all applications.

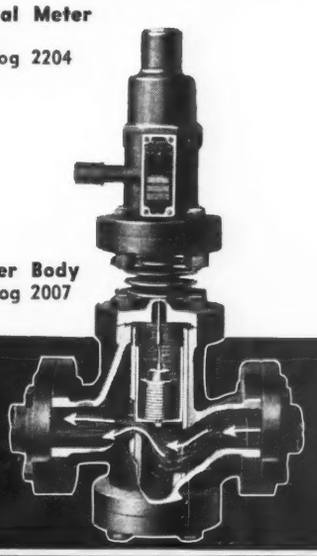
et all the facts about Brown Flow Meters. Features are fully explained in atalog No. 2007. Send for your copy. THE BROWN INSTRUMENT COMANY, a division of Minneapolis-Honeywell Regulator Co., 4490 Wayne Avenue, iladelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter reet—England: Wadsworth Road, Perivale, Middlesex—Stockholm, 16, Sweden: ybrokajen 7.



Brown Electric Meter Body
Write for Catalog 2007



Brown Mechanical Meter Body
Write for Catalog 2204



Brown Area Meter Body
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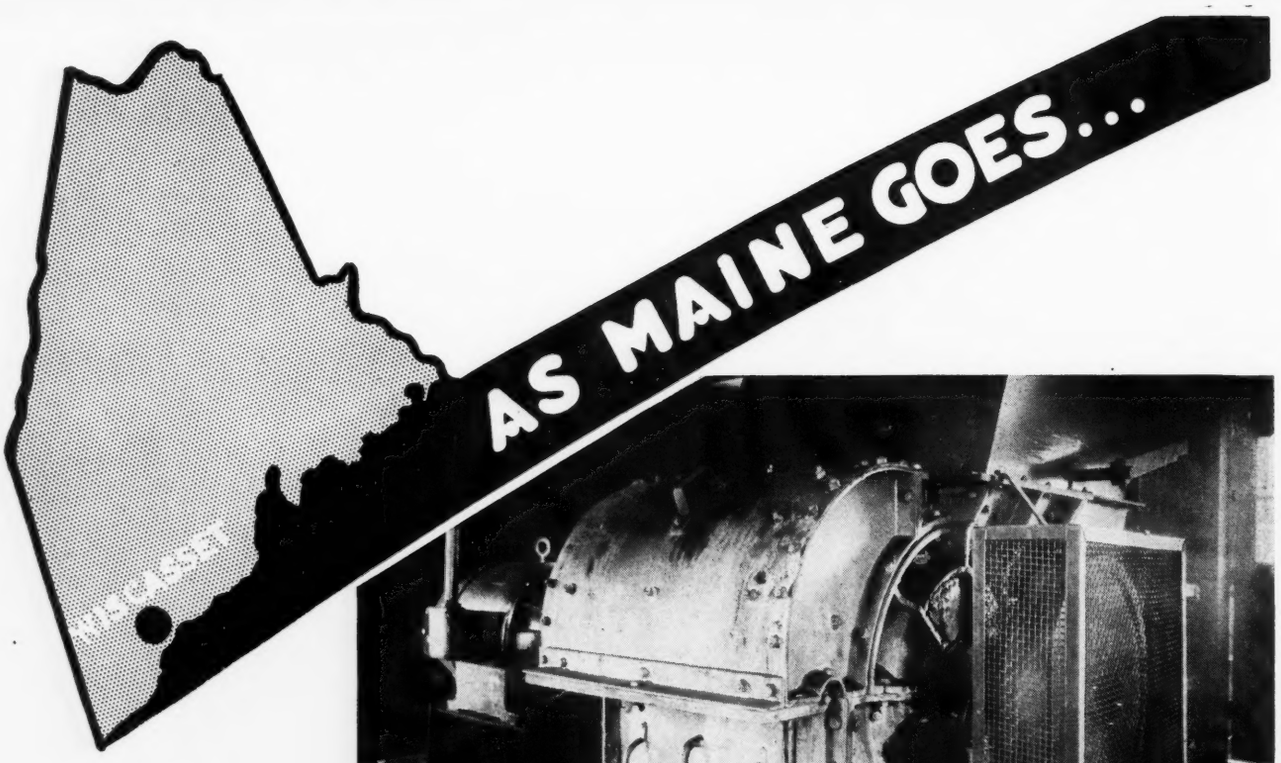
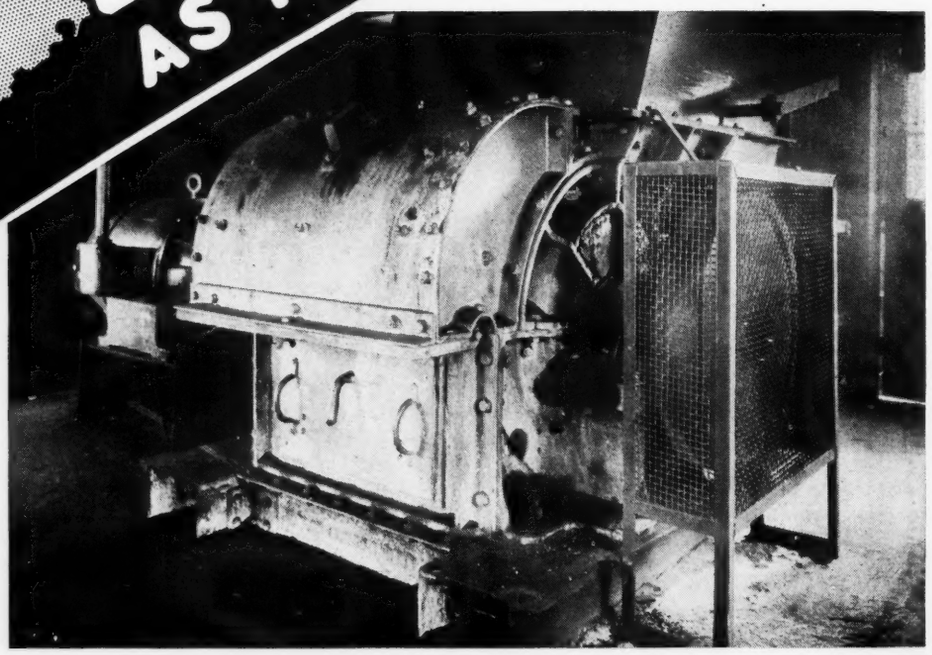
Flow Meters

Accurate Measurement with Simplicity



...so go thrifty plants the country over



TO . . . the "AMERICAN" WAY OF COAL PREPARATION

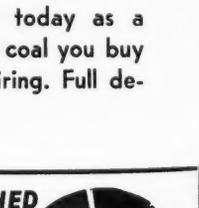
Another power plant in Maine—this time the Wiscasset Station of the Central Maine Power Company—turns to an "American Ring" Crusher to assure proper sizing of coal. (See p. 213, Power, Aug. 1942 for the story of the "American"—equipped plant of the Maine Seaboard Paper Co.)

Engineers in all parts of the country recognize the fact that proper coal preparation is essential to proper combustion and an important factor in helping maintain high capacity operation economically. By turning to the "AMERICAN" WAY of sizing coal, engineers responsible for high power output have found that coal can be crushed exactly as required for maximum efficiency and at the extremely low average crushing cost of less than one cent per ton for all charges. Thriftiness goes right along with good engineering practice wherever "American" Ring Crushers are installed.

Investigate the "AMERICAN" way today as a means of getting the most out of the coal you buy for either stoker or pulverized fuel firing. Full details on request.

COAL IS SPLIT, *NOT* CRUSHED IN THE "AMERICAN"

Exact sizing of coal is assured in the "AMERICAN" RING CRUSHER because it is split rather than crushed. This advantage of the "AMERICAN" is accomplished by an exclusive feature consisting of manganese steel shredder rings one of which is illustrated here.



***Write at once for* ENGINEERING BULLETIN**

AMERICAN PULVERIZER COMPANY

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

1349 MACKLIND AVE., ST. LOUIS, MISSOURI

I'M NEARLY THROUGH ALREADY—YOU KNOW IT TAKES ONLY A JIFFY TO PLUG IN THE BREAKER
YES, THAT SURE IS A NEAT ARRANGEMENT—YOU HAVEN'T HELD US UP AT ALL
GENERAL ELECTRIC AIR CIRCUIT BREAKER

Here's Why This New Removable Breaker Is So Easy to Install

HERE'S a breaker that sets a new record for quick installation. With the case bolted in place, it's easy to connect the cables—there's plenty of room to work. And then it takes but a moment to plug in the breaker unit, which has contacts that readily engage those in the case.

This new removable breaker saves valuable time when in service, too. In fact, it's called the *3-minute breaker*, because, with it, you can re-establish service after temporary faults in less than one minute; inspect the breaker in safety—away from live parts—in less than *two* minutes; and where load conditions have changed, you can interchange breaker units in less than *three* minutes.

Install these new AE-1 breaker units in lighting, power, and motor circuits. They will protect both the circuit wiring and the apparatus connected to the circuit. They will guard against the prolonged delays and the damage often caused when less adequate protective devices are subjected to severe short circuits.

A new illustrated booklet (GEA-3600) tells how and shows where to use these breakers. For a copy, write the G-E office near you, or address *General Electric Co., Schenectady, N. Y.*

THE BREAKER WITH THE DISCONNECT FEATURE

GENERAL ELECTRIC

860-24-7500

IT TOOK A-E-CO TAYLOR STOKERS TO LICK THIS TOUGH PROBLEM!

PROBLEM:

This plant had an unusual problem. It was so close to its coal source that buying new boilers or building an entirely new boiler plant would not produce the customary dollar savings in fuel. Yet, more steam was required than its two boiler plants could provide.

RESULTS:

For the year 1941, 3,505,543,000 lbs. of steam were generated from 333,517,600 lbs. of coal for an average evaporation of 10.51 lbs. steam per lb. coal, burning coal averaging 13,751 BTU per lb. coal as fired. Pressure 165 lbs. G., moisture in steam 1%, feed temperature to boiler 215° F. Combined efficiency 76.6%. Steaming range 50,000 to 150,000 lbs. per hour. Stoker maintenance 1.68c per ton of coal burned. Total tonnage was reduced about 35%, using coal costing about 30c less than formerly.

SOLUTION:

Many surveys and plans were made. Out of them all came the decision to modernize only one of the two boiler houses, installing 5 A-E-CO Hydraulic Taylor Stokers, each with a capacity of 150,000 lbs. steam per hour. The side walls and furnace roof were protected by A-E-CO water walls. Ten of the original 16 boilers were connected in tandem as shown in the side elevation.

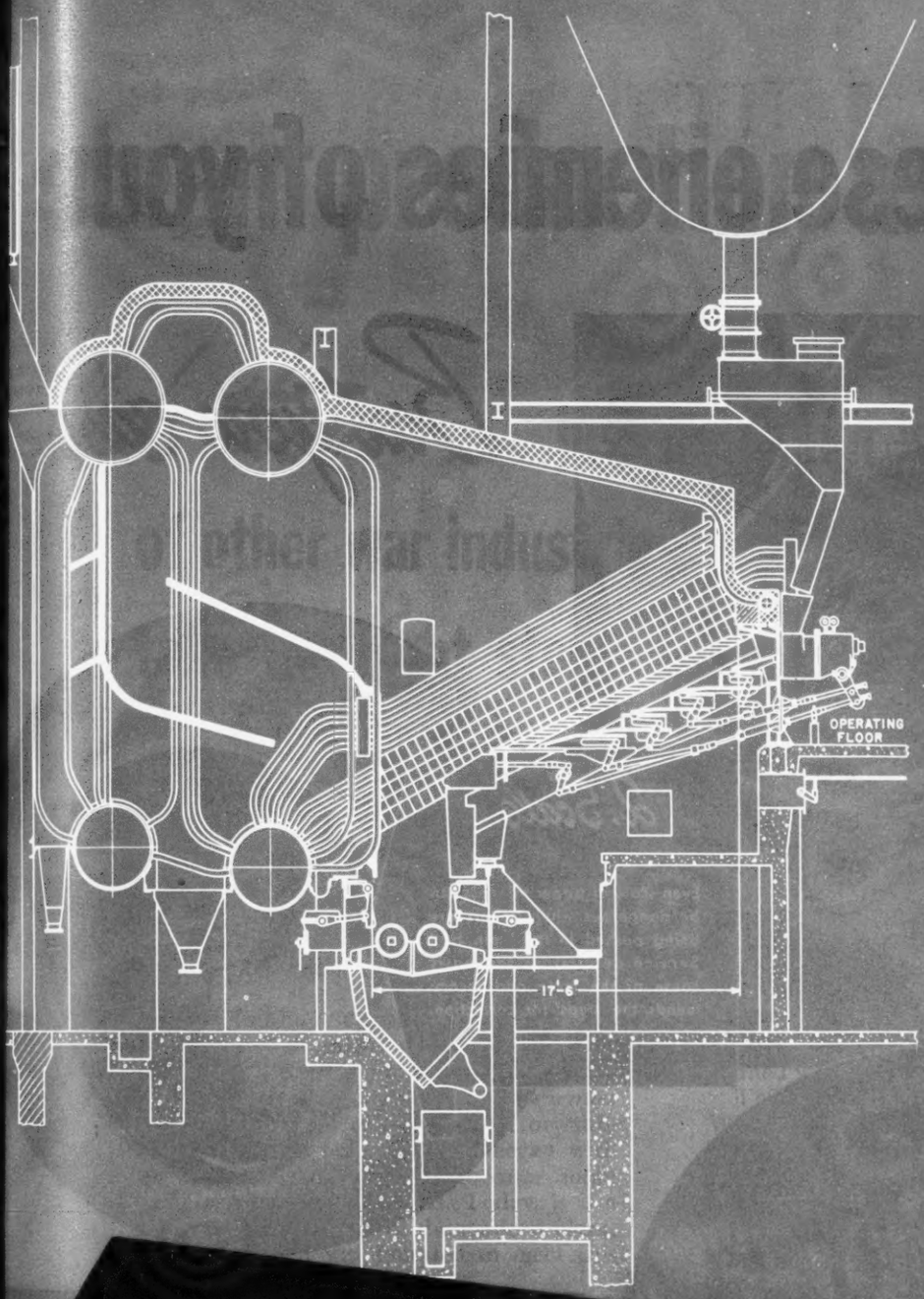
CONCLUSIONS:

Taylor Stokers were selected because they promise the largest return for the least expense. This case is a fine example of the adaptability of the Taylor Stoker to meet special conditions. Not only were the old boilers salvaged, but the capacity of the plant was increased, coal costs were substantially reduced, and only one-half of the former space was used.

ANOTHER CASE IN THE PAPER INDUSTRY

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA



A-E-CO TAYLOR STOKERS ON THE FIRING LINE

*Aluminum Company of America, Edgewater, N. J.
*Aluminum Company of America, NewKensington, Pa.
American Tobacco Co., Inc., Durham, N. C.
Castanea Paper Company, Johnsonburg, Penna.
Chrysler Corporation, DeSoto Plant, Detroit, Mich.
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company, Monroe, Michigan
*Cresson State Sanitarium, Cresson, Penna.
Defiance Milk Products Co., Defiance, Ohio
*DeLaval Steam Turbine Co., Trenton, N. J.
*Detroit Sulphite Pulp & Paper Co., Detroit, Michigan
City of Dover, Ohio
*Draper Corporation, Hopedale, Mass.
Erwin Cotton Mills Co., West Durham, N. C.
*Fisher Body Corporation, Detroit, Michigan
Fisher Body Corporation, Fleetwood Plant, Michigan
*Fisher Body Corporation, Grand Rapids, Michigan
*Fisher Body Corporation, Pontiac, Michigan
Fox Paper Company, Lockland, Ohio
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company, Lockland, Ohio
*General Electric Company, Erie, Penna.
*General Electric Company, Fort Wayne, Ind.
*Greenwood Electric L. & W. Plant, Greenwood, Miss.
*Board Public Works, Hannibal, Mo.
Hill School, Pottstown, Penna.
*Hobart Mfg. Co., Troy, Ohio
*City of Holland, Michigan
*Hope Natural Gas Co., Cornwell Station, West Va.
Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills, Rock Hill, S. C.
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Maybury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills, Lyman, S. C.
*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge, Cleveland, Ohio
*Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
*City of Richmond, Indiana
Sayles Biltmore Bleachery, Biltmore, N. C.
Scotten Dillon Company, Detroit, Michigan
Shelby Cotton Mills, Shelby, N. C.
Sloane-Blabon Corp., Philadelphia, Penna.
*Solvay Process Company, Detroit, Michigan
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
*Borough of Vineland, New Jersey
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*

A-E-CO TAYLOR STOKER

A-E-CO TAYLOR STOKERS
WATER WALLS · ASH HOPPERS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES
LO-HED HOISTS

COMPANY

BEFORE YOU BUY ANY FUEL FIRING EQUIPMENT CONSIDER EACH OF THESE 12 FACTORS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

These enemies of your

But you can

1. Corrosion

Boiler tubes and piping are often destroyed in a few months by corrosion or pitting. Correct treatment of water would prevent this sabotage.

2. Scale

Even scale of paper thinness can be dangerous when boilers are being pushed to the limit. Hall Service determines the basic cause of the scale and recommends the steps for correction.

3. Embrittlement

Tough steel fails like brittle glass when improperly treated boiler water allows caustic embrittlement to start. No sabotage could be worse than this.

4. Carry over

Boiler water belongs in the boiler. When boiler water carries over with the steam, superheaters frequently plug up and the boiler goes down for repairs.

steam production are tough!

lick them . . . just as hundreds of other war industries have, if you take the right step . . . and in time!

LIKE the germs in the human body which are always ready to start their deadly work at the first sign of physical weakness, Scale—Corrosion—Carryover and Embrittlement are ready to cripple your boiler system the moment you let up on your vigilance. You can't get away from their ever-present menace but you *can* protect your plant from them.

How? Through scientifically applied "preventive care" supplied by competent specialists whose life work and training is for the sole purpose of *keeping these boiler enemies under control.* There is no satisfactory substitute for such help. Its need began with the first pressure boiler. It became more acute as pressures increased. Today, it is a necessary requirement of the modern plant.

Hall research was founded to meet this need.

We met it by putting chemists and engineers on the problem who held to their research until they established the basic fundamentals of boiler water conditioning now universally accepted and employed. Your own operations are influenced by this work. Every modern power plant has profited through it.

Perhaps you already knew that. The story of Hall research and subsequent development is common knowledge among power plant technicians. But did you know that it is the very men who did that job who would supervise the servicing of your boilers—that they *are* the Hall operating staff and it is in their laboratories the field engineers are trained who would work on your problems?

Think of this difference. Investigate it. Weigh it against what you have seen of such services. We will be glad to put all the facts before you.

HALL LABORATORIES, INC.
HAGAN BUILDING · PITTSBURGH, PA.

HALL SYSTEM
of Boiler Water Conditioning

HALL SERVICE IN A NUTSHELL

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning.

In addition, with your full cooperation Hall Service:

1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

Waste Warden Tells HOW TO GET LONGER SERVICE

from your Welding and Cutting Apparatus

TORCHES

1. Blow out hose before attaching torch.
2. Be sure the torch seat is clean.
3. Be sure packing nut is tight.
4. Also—don't use torch as a hammer. A torch built to withstand such abuse would be too heavy to handle.

TIPS

1. Clean tips with proper size standard cleaning drills only. Be sure to use a drill one size smaller than the orifice about to be cleaned. Makeshift wire cleaners enlarge tip openings and upset flame balance.
2. Store all tips in racks to prevent damage. Tips battered at seating end waste gas.

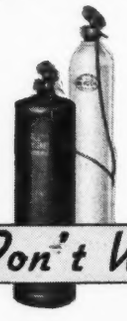
REGULATORS

1. Keep regulator seat dust free. Before attaching regulator clean outlet by cracking cylinder; clean gland by a short blast from cylinder.
2. Release regulator adjusting screw when changing cylinders. This prevents high pressure shocks to regulator seat.
3. Always open cylinder valve slowly when installing regulator. Repeated sudden cracking of cylinder into regulator promotes leakage.

DON'T JUNK DAMAGED APPARATUS

Today regulators, torches and tips are hard to replace. Good maintenance practices will help you get longer service and better performance from your gas welding and cutting apparatus.

But if a torch, tip, or regulator is damaged—don't junk it. Instead send it to an Airco Apparatus Repair shop where factory-trained repairmen will make it work like new. This nationwide repair service is available through your nearest Airco office.



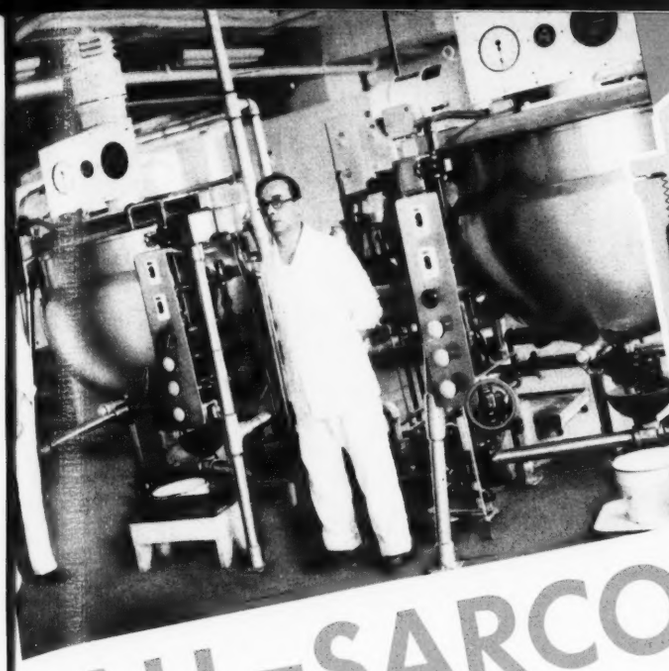
AIR REDUCTION

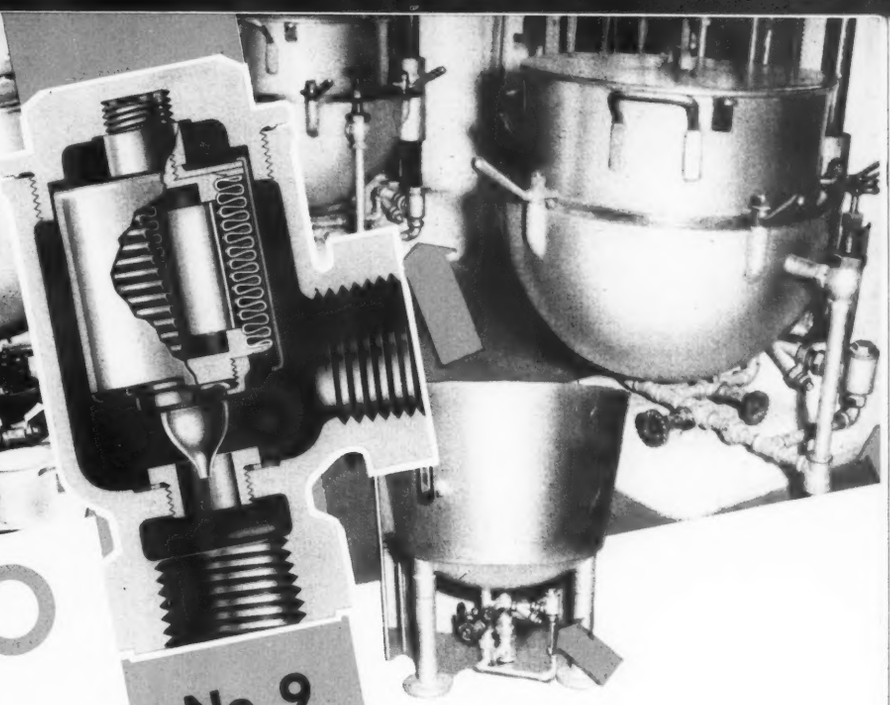
60 EAST 42nd STREET, NEW YORK, N. Y.

IN TEXAS: **MAGNOLIA-AIRCO GAS PRODUCTS COMPANY**

AIRCO WILSON

OXYGEN IS PRODUCTION — *Don't Waste it!*





ALL-SARCO Chemical and Food Plants

Men and women in all-white uniforms, chrome-nickel equipment everywhere, and dozens of cookers, mixers and agitators, all equipped with Sarco No. 9 Thermostatic Steam Traps make this New York plant an outstanding example of streamlined efficiency.

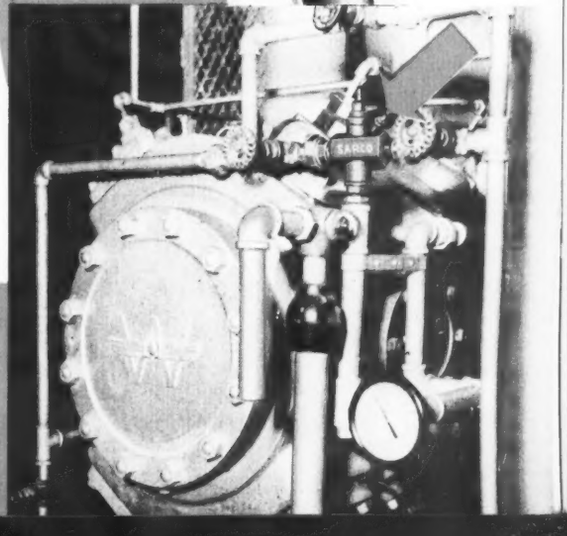
The Sarco No. 9 is noted for its ability to extract all the usable heat before its wide ports open to release the condensate. It is small, low cost, works at all pressures, and is ideal for use on each coil of batteries of steam equipment in the food, process and chemical industries. Ask for Catalog No. 250.

No. 9

SARCO No. 9 Thermostatic Steam Traps are used extensively on cookers, mixers, and agitators.

TR 40

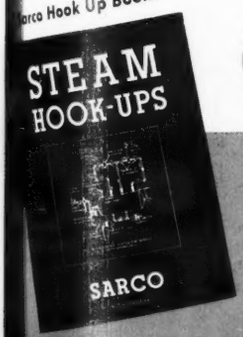
Sarco TR-40 Cooling Control on Compressor.



WATER COST CUT IN HALF

Checked by meter at this plant, the cooling water used on three compressors (one shown at right) was reduced 75,000 cubic feet per year, by using the Sarco TR-40 cooling control. Another TR-40 is used on the after-cooler. Test charts show that the compressor operates at top efficiency and the temperature of the delivered air is always the same. These and a half dozen other heating and cooling controls are described in the Sarco Catalogs 700 and 800.

Ask for the New Enlarged Sarco Hook Up Book.

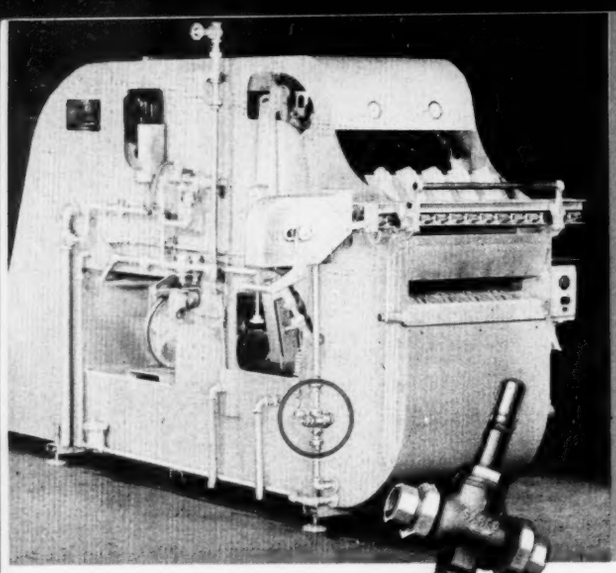


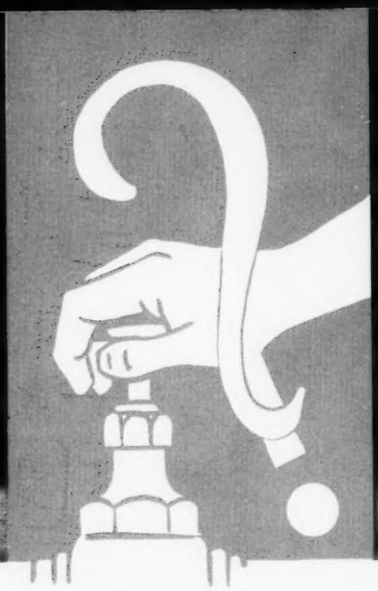
SARCO Saves Steam

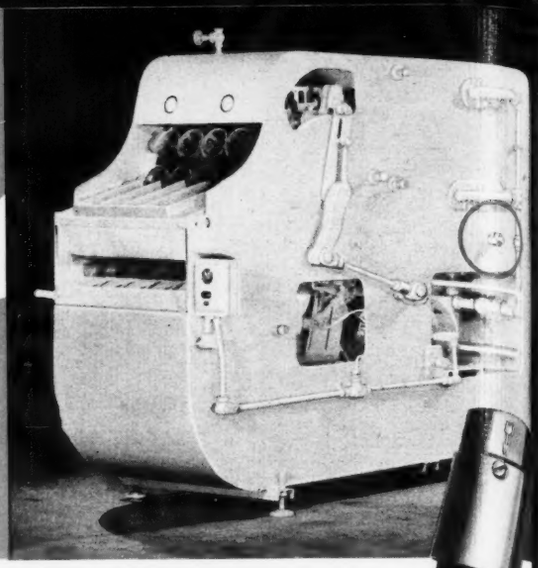
SARCO COMPANY, INC., 475 FIFTH AVE., NEW YORK

Represented in Principal Cities

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO







Why Use Your Hands

When 80% of all industrial applications can be regulated by inexpensive

Sarco Temperature Control

TR-50

This Sarco TR-50 temperature regulator is one of the rigid stem type controls which is inexpensive and recommended for control of heating or cooling where the supply can be piped to the point where the bulb is inserted.

Available in sizes ½" to 2" for temperatures from 50 to 250°F. and steam pressures to 125 lbs. Catalog No. 600.

A skilled worker is a poor valve tender at best. His active mind and hands are too busy elsewhere — and his time is needed now more than ever before. That's one reason why Cherry-Burrell Corporation equips this ingenious bottle washer with Sarco type TR-50 controls for the wash water and Sarco No. 87S for the rinse tanks. Now every machine that leaves their plant is bound to perform — always the same temperatures — no cracked bottles, no wasted heat or water.

When you buy steam heated or water cooled equipment, ask for Sarco Temperature Control. It will give you the speed and reliability that you need now and the economy you will surely need when the rush is over.

No. 87 S

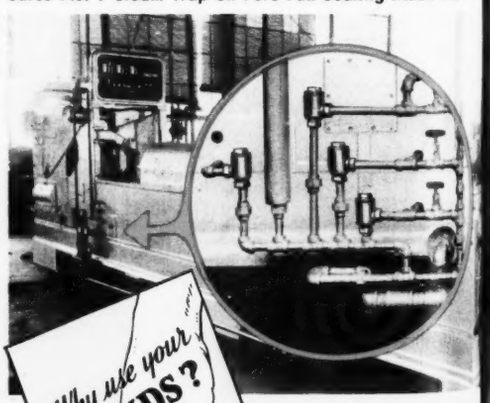
This Sarco Thermoton combines a silent steam injector with automatic temperature control at little more than the cost of a steam nozzle. Provides adequate control of water or other liquids heated by direct injection of steam. Available in sizes ½" to 1¼" for temperatures to 250°F. and steam pressures to 200 lbs. Catalog No. 550 also shows Thermoton controls for steam coils and jackets on process equipment or storage tanks.

Manufacturers of Steam Equipment say SARCO is OK—

The only way they can be sure that their machinery will operate at top speed with known efficiency and reliability over a long term of years. Here's a partial list of machinery that is Sarco equipped before it leaves their plants:

Air Conditioners
Bottle Washers
Can Washers
Chocolate Dip
Coffee Urns
Compressors
Cookers
Coolers
Degreasers
Diesel Engines
Dryers
Heaters
Hot Water Tanks
Humidifiers
Kettles
Pasteurizers
Plating Tanks
Preheaters
Steam Tables
Stills
Vacuum Pans
Vacuum Sealing

Sarco No. 9 Steam Trap on Pure-Pak Sealing Machine.



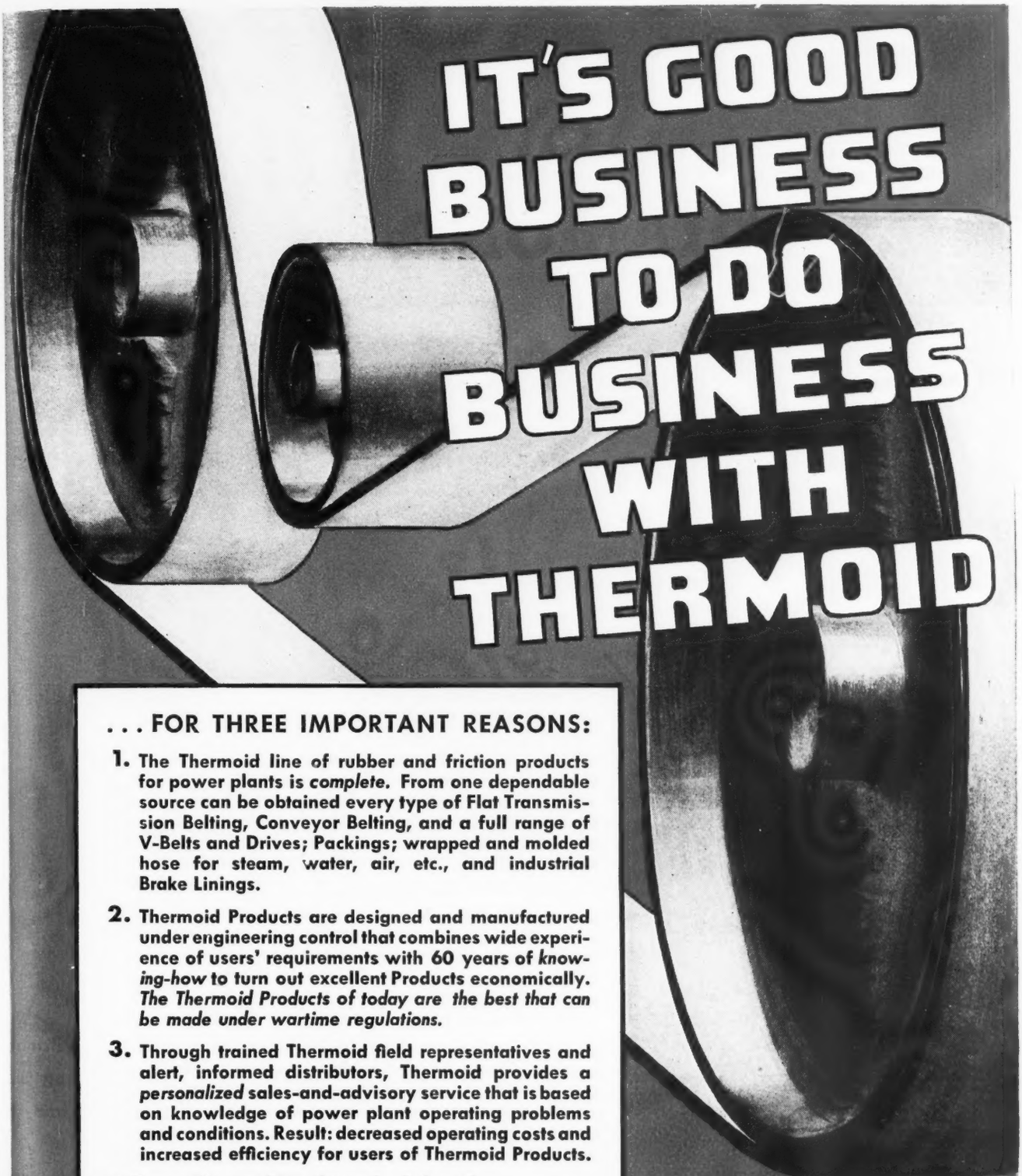
This booklet describes all types of Sarco heating and cooling controls. Ask for it.

SARCO Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

Represented in Principal Cities



IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID

. . . FOR THREE IMPORTANT REASONS:

1. The Thermoid line of rubber and friction products for power plants is *complete.* From one dependable source can be obtained every type of Flat Transmission Belting, Conveyor Belting, and a full range of V-Belts and Drives; Packings; wrapped and molded hose for steam, water, air, etc., and industrial Brake Linings.

2. Thermoid Products are designed and manufactured under engineering control that combines wide experience of users' requirements with 60 years of *know-ing-how* to turn out excellent Products economically. *The Thermoid Products of today are the best that can be made under wartime regulations.*

3. Through trained Thermoid field representatives and alert, informed distributors, Thermoid provides a *personalized* sales-and-advisory service that is based on knowledge of power plant operating problems and conditions. Result: decreased operating costs and increased efficiency for users of Thermoid Products.

Call your Thermoid Distributor for help with today's operating and maintenance problems.

Thermoid
INDUSTRIAL RUBBER PRODUCTS
QUALITY VALUE SERVICE

Thermoid Rubber

DIVISION OF THERMOID CO. • TRENTON • NEW JERSEY

DIAMOND
Soot Blowers
have been "Drafted"

How to make the most of those you now have

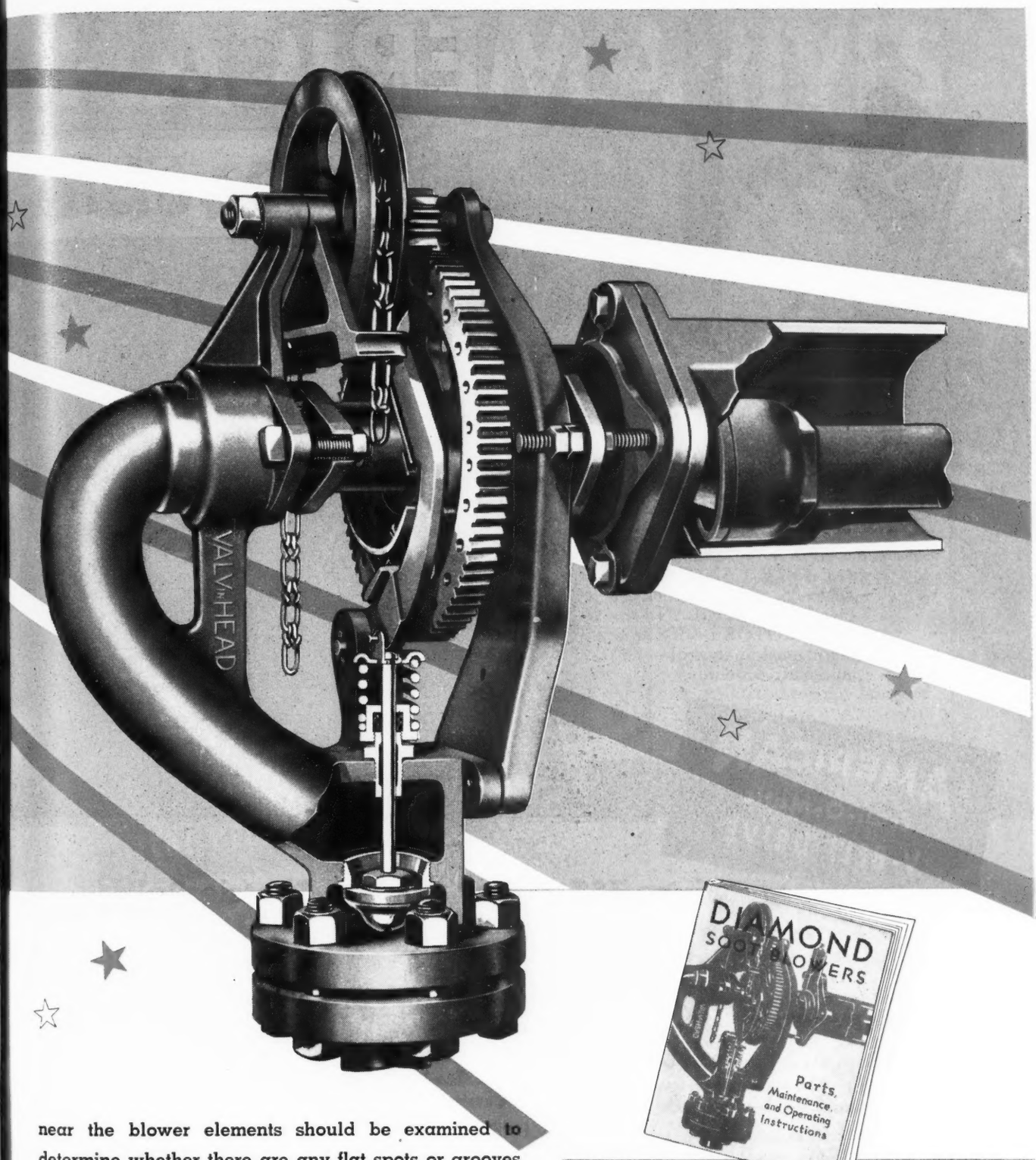
AT THE present time, nearly the entire product of the Diamond plant is "drafted"—earmarked for war industry, navy or marine service.

As a result, we have had extreme difficulty in supplying many of our old customers with their needs. Even when priorities are high, it often takes a longer time than we would like to fill an order. As a result, some customers have had to get along with the soot blowers they have. We deeply regret this situation and we want to do everything possible to alleviate it.

Much can be done to keep your soot blowers in service and up to the mark in efficiency. Careful treatment will enable you to prolong their service life far beyond usual expectations; and this is easy to do.

For example:

See to it that your blowers are regularly inspected and lubricated. Every time a boiler equipped with Diamond Soot Blowers is taken out of service, the equipment should be checked carefully to see that bearings are tight, that the nozzles register correctly with boiler tubes, and that blowing ranges are right. Boiler tubes and headers



near the blower elements should be examined to determine whether there are any flat spots or grooves which indicate abrasion.

Repairs or adjustments should be made before the boiler goes back into service.

These, and other measures which will be detailed in future advertisements, will help you get the service you need.

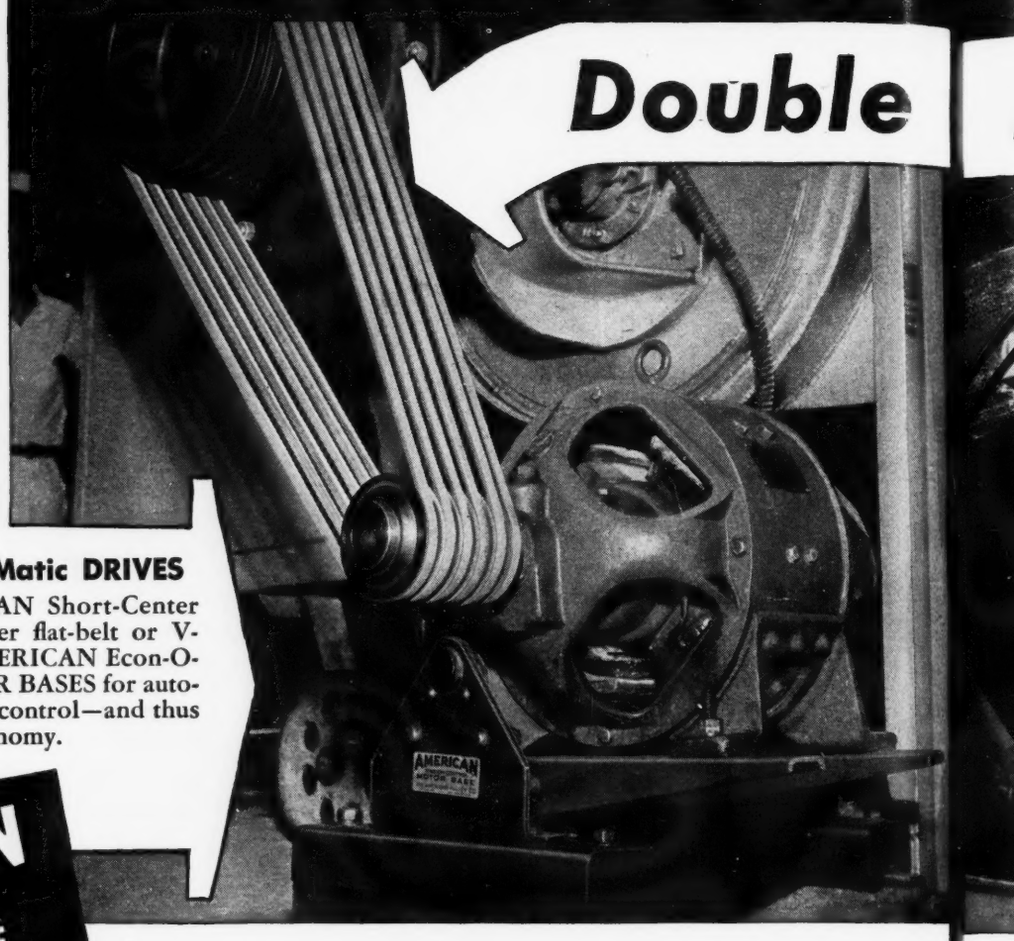
We have a booklet on servicing Diamond Soot Blowers. Send for a copy.

DIAMOND POWER SPECIALTY CORP.
DETROIT, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

Navy "E" for Excellence
Awarded Feb. 12, 1942
Star added July 29, 1942

AMERICAN Double



***Econ-O-Matic DRIVES**
are AMERICAN Short-Center DRIVES, either flat-belt or V-belt, with AMERICAN Econ-O-Matic MOTOR BASES for automatic tension control—and thus automatic economy.

AMERICAN
Econ-O-Matic
V-BELT DRIVE

Gives 75% Faster Mix for Tootsie Rolls

Electrical motors are becoming scarce—have high priority ratings. A WPB statement urges "overloading" of motors beyond their rated capacity—to increase production with motors available. Here is where AMERICAN Econ-O-Matic DRIVES . . . with the automatic tension-control of Econ-O-Matic MOTOR BASES . . . do a real job; they permit you to "overload" motors, to get more production, at the same time they lengthen belt life.

Several months ago, The Sweets Company of America—makers of Tootsie Rolls with a candy production of more than 110,000 pounds daily—equipped a new chocolate mixing machine with an AMERICAN Econ-O-Matic V-Belt DRIVE.

Result: Today, production is up . . . Tootsie Rolls Chocolate is mixed 75% faster . . . the mix is smoother . . . maintenance costs have been zero!

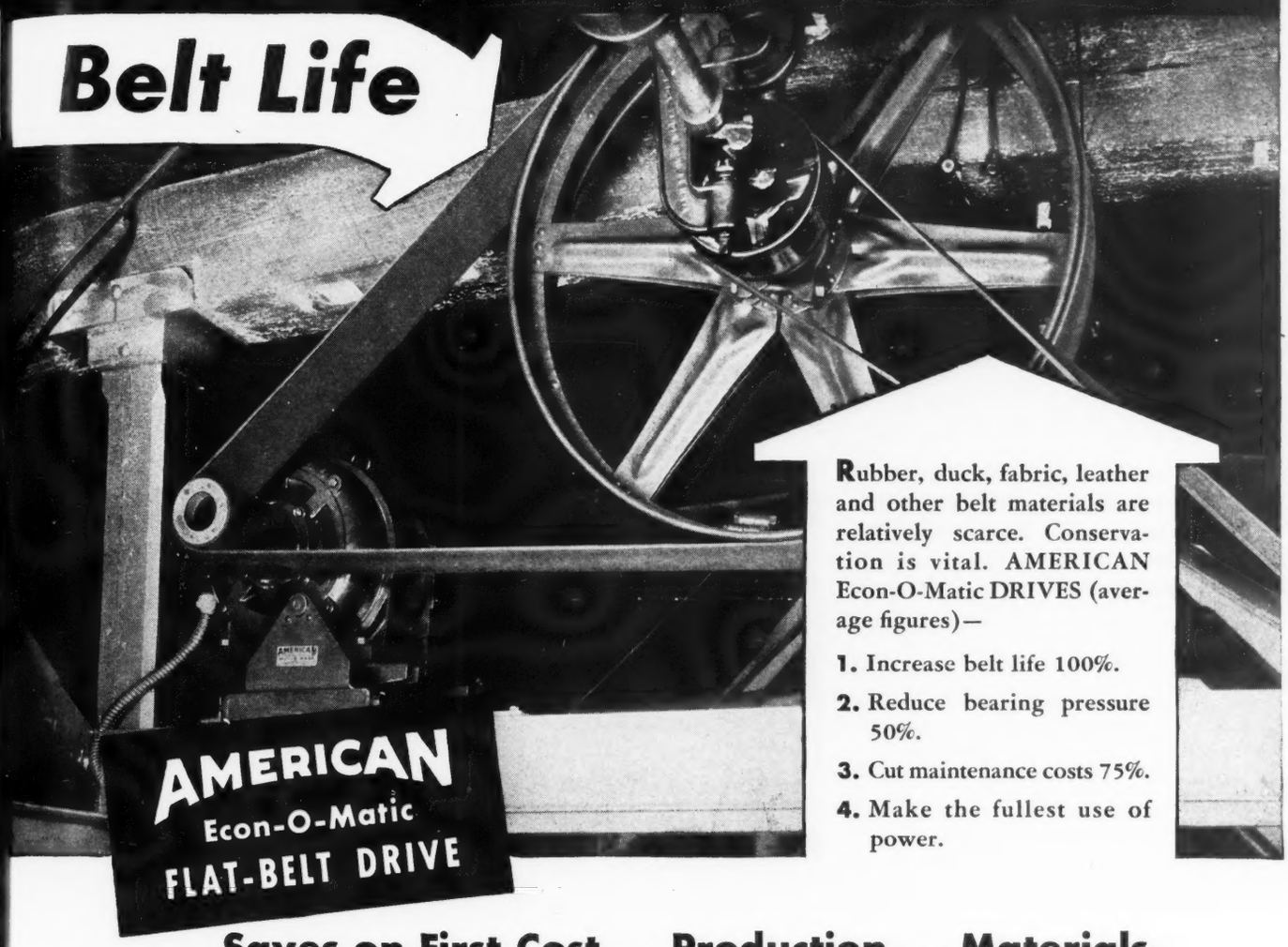
This AMERICAN Econ-O-Matic DRIVE replaces an overhead drive integrated into the company's power transmission system.

There's an AMERICAN Econ-O-Matic DRIVE to fit your needs . . . to "up" production and conserve materials!

The American Pulley
4242 WISSAHICKON AVENUE

Econ-O-Matic* DRIVES

Belt Life



Rubber, duck, fabric, leather and other belt materials are relatively scarce. Conservation is vital. AMERICAN Econ-O-Matic DRIVES (average figures)—

1. Increase belt life 100%.
2. Reduce bearing pressure 50%.
3. Cut maintenance costs 75%.
4. Make the fullest use of power.

Saves on First Cost . . . Production . . . Materials for New York Wire Cloth Co.

One AMERICAN Econ-O-Matic *Flat-Belt* DRIVE was installed by the New York Wire Cloth Co. to test its efficiency. At the conclusion of the test, this customer ordered three more Econ-O-Matics! Savings:—

1. Across-the-line starters now used instead of costlier reduced voltage types—saving *initial cost.*
2. R.P.M.'s maintained—no belt slip—saving *production.*
3. Less belting, fewer shafts and pulleys required—saving *materials.*

Equipment included A-4 and A-6 AMERICAN Econ-O-Matic MOTOR BASES . . . 5½" x 7" and 5½" x 9" AMERICAN *Hi-Torque* MOTOR PULLEYS (driving pulleys) . . . 40" x 6", 42" x 8" and 42" x 10" AMERICAN *Steel Split* PULLEYS (lineshaft pulleys) . . . 5, 10 and 15 HP motors, operating at 1200 RPM.

Conservation of belts and bearings—and fullest use of power are now sheer necessities . . . necessities that AMERICAN Econ-O-Matic DRIVES are helping hundreds of manufacturers to meet.

★ ★ ★

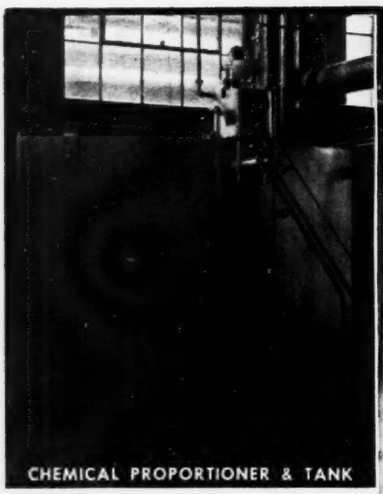
NEW COMPLETE CATALOG

36 pages . . . filled with factual data . . . comprehensively illustrated . . . tells you what AMERICAN Econ-O-Matic DRIVES are and can do to increase power, lower maintenance costs, and save equipment in your plant. Write for your copy of AMERICAN Econ-O-Matic DRIVES Catalog today!

Company

PHILADELPHIA, PA.

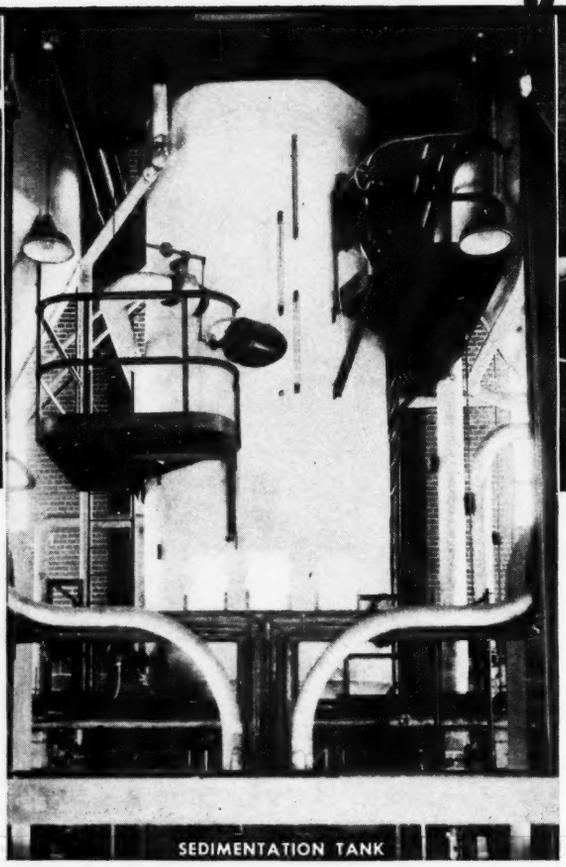
More than Water Softening—



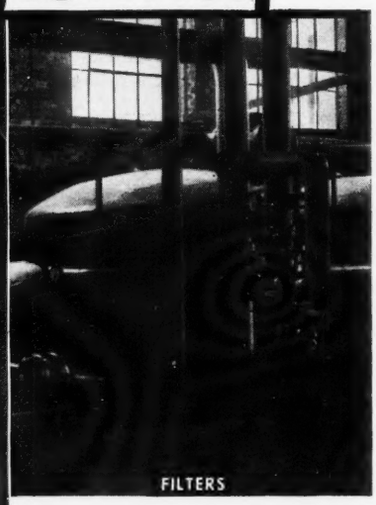
CHEMICAL PROPORTIONER & TANK

Above is shown a Cochrane Chemical Proportioning and Mixing Tank with Proportioner shown at top of tank. Proportioner automatically adjusts chemicals to changes in rate of flow.

Cochrane Sedimentation Tank where water is heated and reagents mixed with it and softening takes place.



SEDIMENTATION TANK



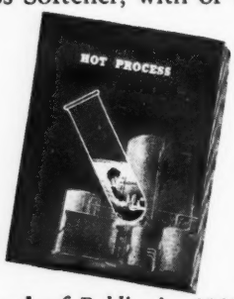
FILTERS

Cochrane Filters are of the pressure type, and charged with a Non-Silicious Filtering Material. The softened and settled water passes through these filters, after which it is pumped to the boilers.

Precipitates settle in sedimentation Chamber and softened water is withdrawn through uptake funnel to filters.

Cochrane Water Conditioning Fits Treatment to Problem

THE ENVIABLE reputation enjoyed by the Cochrane Corporation in the field of boiler feedwater treatment is associated in many minds with the development of the Hot Process Softener. While this has been a major contribution to the development of the modern high pressure boiler plant, Cochrane's real authority rests on the solution of all the factors that enter into any feedwater problem. The Cochrane Hot Process Softener, with or without integral deaerating equipment, is generally the basic unit in the treatment of boiler feedwater for the prevention of scale, protection against corrosion, minimizing of carry-over, and protection against embrittlement of boiler metal. But Cochrane Water Conditioning comprises a thorough study of the conditions and the objectives sought, then the specification of method and apparatus recommended.



A study of Publication 3000 will repay executives. Write for a copy.

COCHRANE CORPORATION • 3106 N. 17th Street • PHILADELPHIA, PA.

COCHRANE

HOT PROCESS SOFTENERS • DEAERATORS • BLOW-OFF SYSTEMS • FLOW METERS • SPECIALTIES

SHAW PIPING

Engaged 100% in War Production of

PIPING PREFABRICATION AND INSTALLATION

TO meet America's great war needs . . . plants are expanding, new ones are being built. In this vital construction work — piping of all sorts, shapes and sizes is needed. To speed these piping installations, Shaw maintains, in addition to its home plants, a complete and highly skilled field force with complete facilities for doing fast, efficient work, right on the job. Thus work moves faster — vital time is saved.

Since 1893, Benjamin F. Shaw Company has specialized in prefabricated piping. To meet the demands of the country at war — Shaw brings to every job undertaken — the skill resulting from fifty years of experience.

Our engineering staff is available to you on any piping problem. We invite your inquiry.

Specializing in Piping for

- ★ ORDNANCE WORKS
- ★ SYNTHETIC RUBBER PLANTS
- ★ AVIATION GASOLINE PLANTS
- ★ POWER & EVERY TYPE OF PROCESSING PLANTS

Geo. W. Stewart

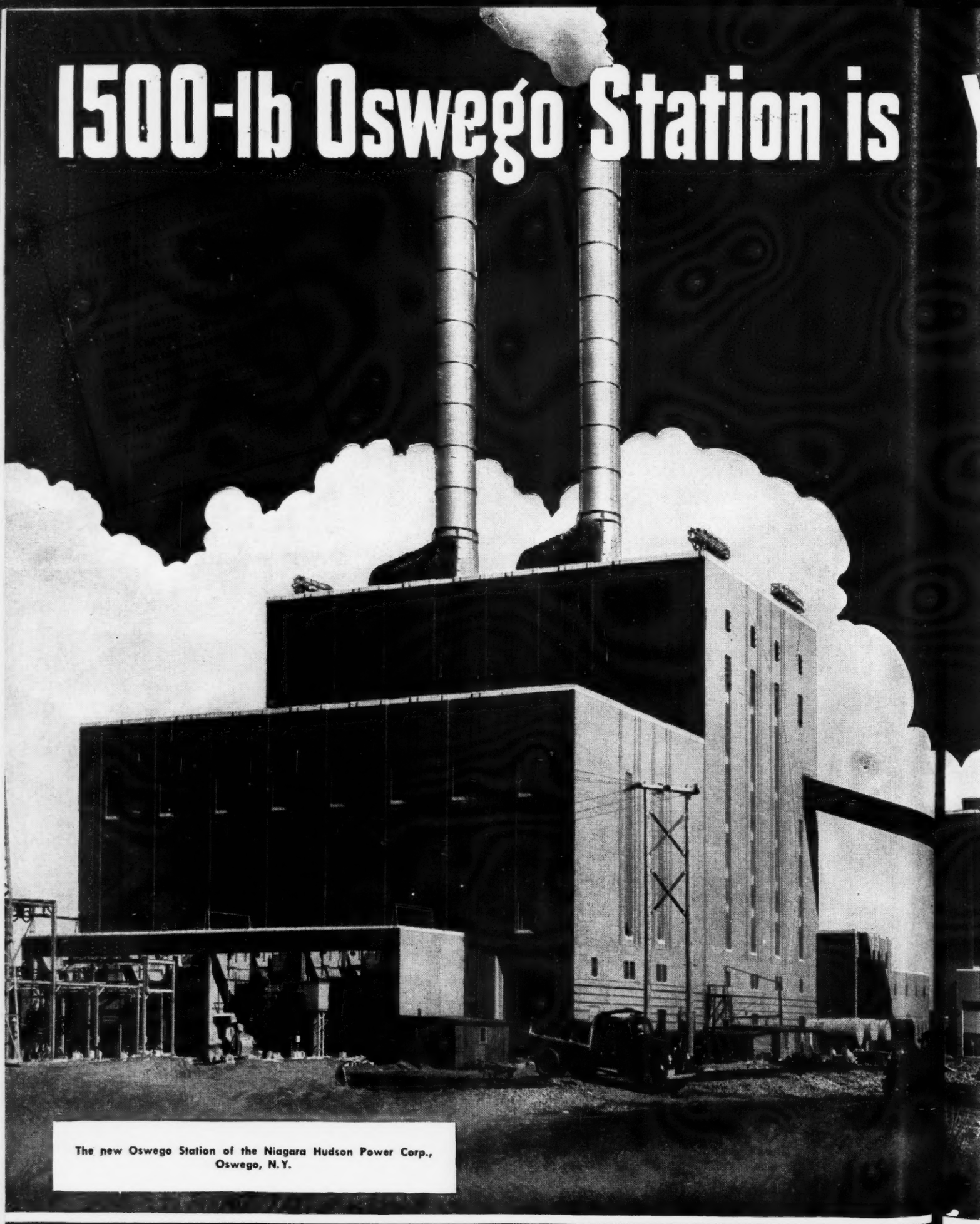
Sales Manager

BENJ. F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS, CONTRACTORS AND DISTRIBUTORS

1500-lb Oswego Station is



The new Oswego Station of the Niagara Hudson Power Corp., Oswego, N.Y.

YARWAY

Yarway Unit Tandem Equipped

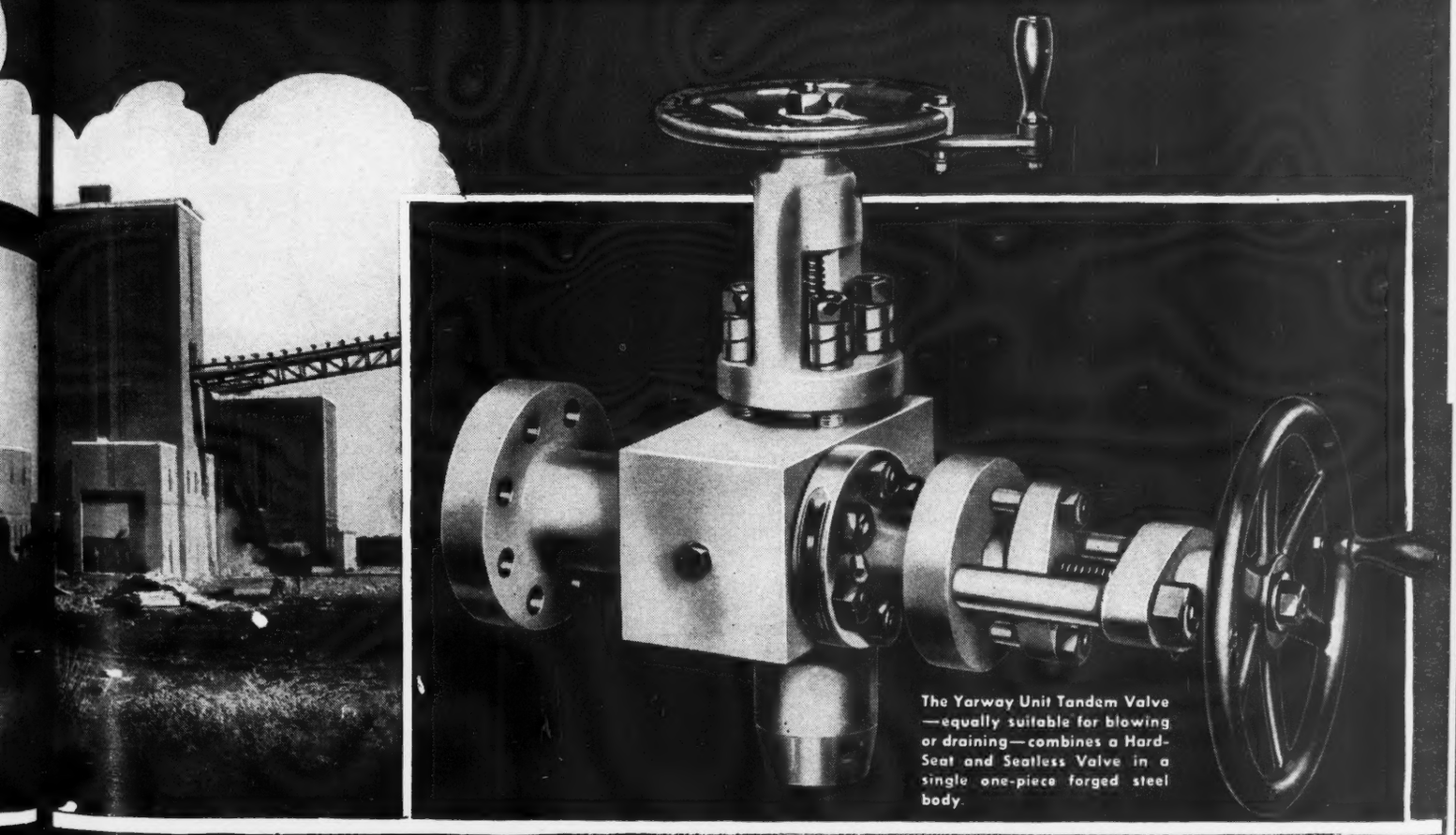
ANOTHER of the many important high-pressure utility stations to select Yarway Unit Tandem Blow-Off Valves for the most difficult of all valve services—the 1500-lb pressure Oswego Station of the Niagara Hudson Power Corp. This installation brings the number of Yarway equipped plants designed for 900 lb pressure and over to ninety-seven.

The reason for Yarway's outstanding preference is found in such records as —"*Still tight after 3000 blows at more than 1300 lbs pressure without replacement of a single part or repairs of any nature.*"

Good boiler engineering demands equally sound engineering in the accessories that become part of it. It is not only *protection for your investment, but cheap insurance against trouble and expense.*

Write for Catalog No. 431 for pressures from 400 lbs to 2500 lbs. Catalog 422 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

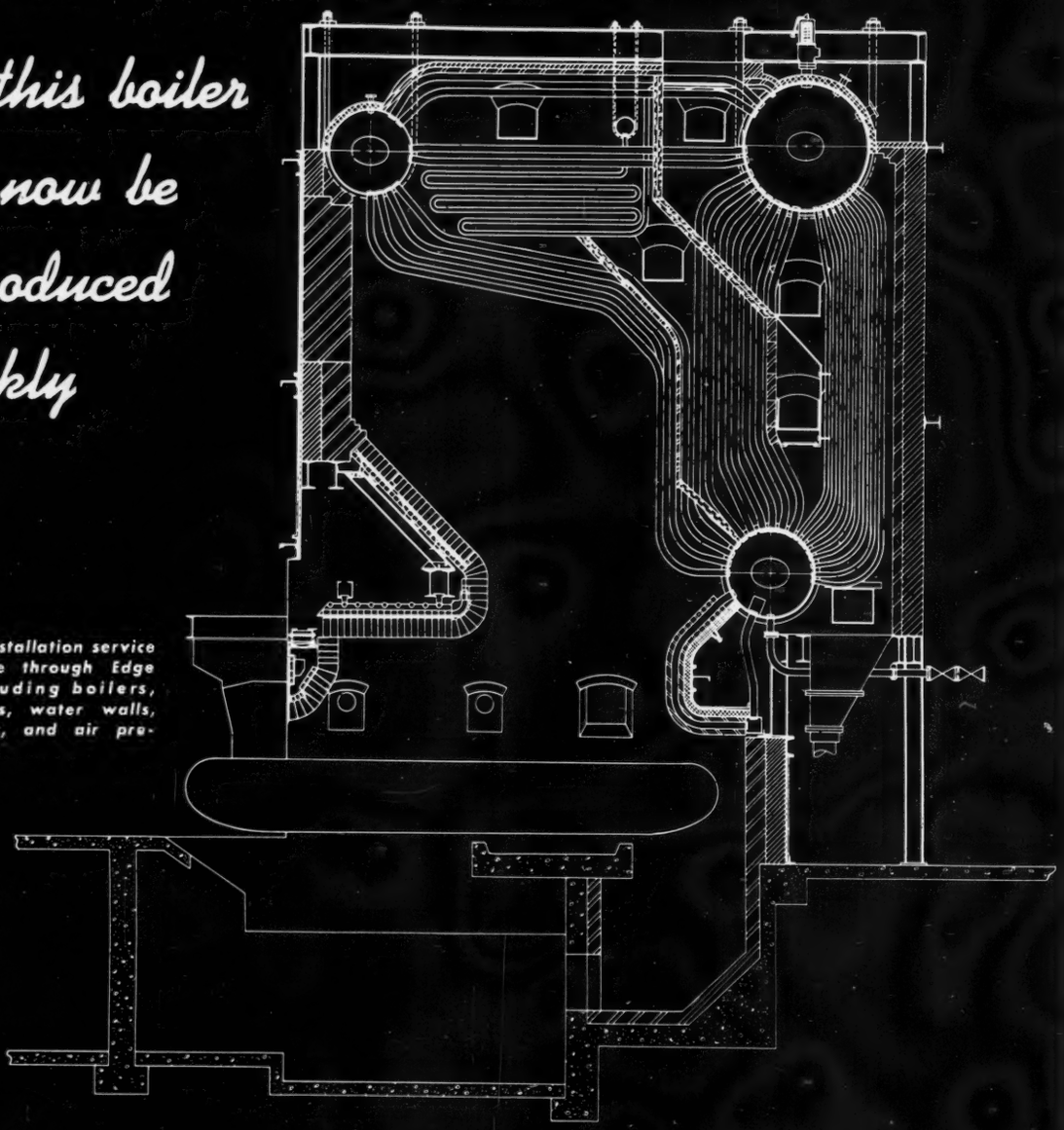


The Yarway Unit Tandem Valve —equally suitable for blowing or draining—combines a Hard-Seat and Seatless Valve in a single one-piece forged steel body.

BLOW-OFF VALVES

Built by EDGE MOOR
for NORTHWESTERN PUBLIC SERVICE

. . . this boiler can now be reproduced quickly



Complete installation service is available through Edge Moor including boilers, superheaters, water walls, economizers, and air preheaters.

This Edge Moor Boiler—designed for burning North Dakota lignite—has a capacity of 43,000# of steam per hour at 275# pressure and 650° F. total steam temperature. It has met all guarantees for performance.

Availability of complete drawings and fabrication experience make it possible for Edge Moor to duplicate this boiler quickly and exactly to original specifications.

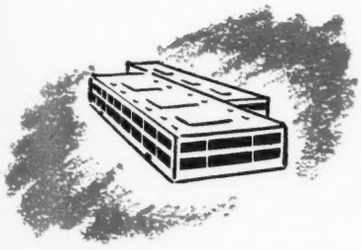
EDGE MOOR IRON WORKS, INC. 30 ROCKEFELLER PLAZA NEW YORK, N. Y.

KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

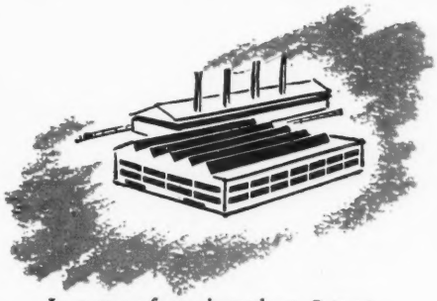
IN CANADA:— UNITED STEEL CORPORATION, LTD., TORONTO, MONTREAL

SAVED --with Load-center Power Distribution

Tons of Copper and Steel
Weeks of Valuable Time



In an ordnance plant, 5 tons



In a manufacturing plant, 8 tons

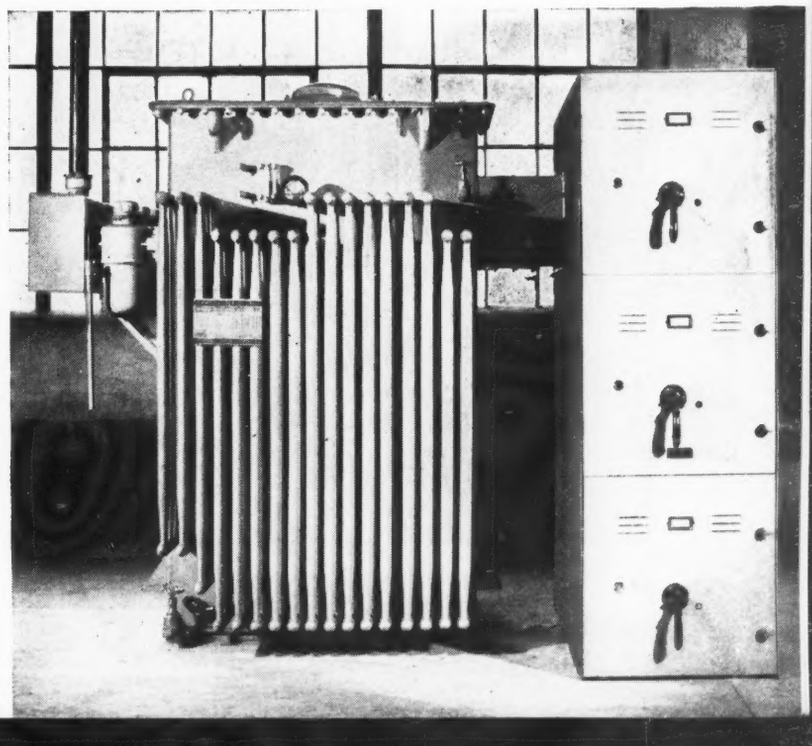
In a large shipyard, 145 tons

ON THESE three projects alone, load-center electric distribution systems, with their copper-stingy short secondaries, made possible the conservation of vast quantities of vital copper and steel. And the jobs were completed in *one to six months' less time* than would have been required if old-style systems had been used.

Using *standard,* "packaged" equipment, a load-center system presents very few design problems, can be purchased and installed much more easily and quickly, and at *lower* over-all cost. Performance of electric equipment is materially improved by the reduction of voltage drop in the *short* low-voltage feeders. Write for more detailed information. *General Electric Co., Schenectady, N. Y.*

LIGHTING MATERIALS, TOO!

Load-center distribution is especially suitable for fluorescent lighting using General Electric's new Forlamp ballast, which operates within a range from 250 to 280 volts. This new ballast requires only about one-half as much copper, iron and steel, and aluminum as was required for the most economical ballast hook-up heretofore available for operating four 100-watt lamps.



The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

In the load-center system, power is distributed at relatively high voltage (2.4 to 13.2 kv) to compact unit substations located near the centers of electrical load areas—eliminating the need for long, heavy, low-voltage feeders from a distant substation. These factory-assembled, safety-metal-enclosed units are quickly and easily installed right in working areas without expensive vault construction—thanks to non-inflammable Pyranol.

GENERAL ELECTRIC

302-13-170B

ROUND BOLTED BONNETS

- **Approved by Construction Codes:**
  Round Bonnets meet all requirements for low or high pressure services.
- **Minimum distortion under pressure:**
  Pressure vessels tend to assume spherical shapes under stress. Only round bonnets keep distortion under pressure to a minimum.
- **Lowest Maintenance:**
  Use of round gaskets cut maintenance costs to the bone. No "fussing" with rectangular, oval and other odd shaped templates and gaskets.
- **Prolonged Service Life:**
  Vogt Bonnets and Bodies have the recognized wide safety margin of DROP FORGINGS. This, combined with correct design and proper materials assures continuous operation with highest operating efficiency.

Vogt BOLTED BONNET VALVES

UTILIZE THE *Round* BOLTED DESIGN
for ALL SIZES and ALL PRESSURES
THIS INCLUDES *EVEN* THE LOW-PRESSURE
150 AND 300 POUND VALVES

HAVE YOU a copy?

Vogt's complete line of Drop Forged Steel Gate Valves is described in this brochure. Sent upon request.

HENRY VOGT MACHINE CO., INC.

LOUISVILLE, KENTUCKY

NEW YORK • PHILADELPHIA • CLEVELAND • CINCINNATI
ST. LOUIS • CHICAGO • DALLAS

DROP FORGED STEEL VALVES

SHIPS FOR VICTORY
OVER 750 LIBERTY SHIPS
will be equipped with
KELLOGG MAIN CONDENSERS
HEAT TRANSFER DIVISION
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225 BROADWAY, N. Y.
Aircraft Carriers and Destroyers use KELLOGG prefabricated High Pressure Piping

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"Masterflex" Prefabricated Piping Systems · "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · JUIK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

HOW TO MAKE YOUR MULTIPLE

...WITH LESS OUTAGE AND LOWER MAINTENANCE

If yours is one of the many plants operating multiple-retort underfeed stokers, here are some suggestions that will help you get longer life out of your present equipment and minimize outage for repairs or replacements. While they relate primarily to the C-E multiple-retort stokers here illustrated, they are largely applicable to all stokers of this general type.

OPERATION

GENERAL The two main causes of excessive outage and maintenance are (1) sustained or frequent overloading of stoker and (2) operating with insufficient draft.

Where prolonged overloading is unavoidable, as is often the case in these days, good operation and careful attention to maintenance are especially important. Frequently, in such cases, the use of a higher quality coal, well suited to underfeed stoker operation, will make it possible to carry the increased load without excessive outage or maintenance costs.

Observe fuel bed and furnace conditions frequently. It is easier to correct unsatisfactory conditions in the early stage before serious difficulties develop.

FIRE (1) Keep fire out of retort. This condition can result from too thin a fuel bed, from banking with insufficient fuel or from running with an empty hopper.

(2) Keep coal hopper well filled. Avoid segregation of coal sizes in hopper. Use mechanically-operated swinging spout, traveling larry or non-segregating spreader chute. A uniform mixture is absolutely essential to a good fuel bed.

(3) Be sure fuel distributes uniformly over the stoker. The stroke of the secondary rams can be adjusted at the front of the stoker to control distribution.

(4) Operate so that lower ends of bars in the overfeed section, adjacent to the ash disposal section, are always covered—6 in. to 9 in. deep is about right. This is particularly important on dump grate equipped stokers after the ash has been dropped. Lengthen stroke of rams and overfeed section to assure this condition if necessary.

(5) Always feed in sufficient fuel when banking. Build up fuel bed at front of stoker. Reduce air supply gradually to permit protective layer of ash to form next to the grate. Never cut off air completely under active fuel bed. It may be necessary to operate stoker occasionally when on bank to prevent fuel bed from burning down into retorts.

(6) Do not permit too much refuse to accumulate on dump grates or in ash pit. See that refuse moves away properly on continuous discharge and clinker grinder type stokers.

(7) Depth of fuel bed is very important. If too thin, fire may burn down into retort and damage retort sides. If too heavy, poor air distribution will result, causing spotty, uneven fire; holes in fuel bed; smoke and reduced efficiency. Correct depth of fuel bed above top of tuyeres may be anywhere from 16 in. to 20 in., depending upon analysis and burning characteristics of coal used.

DRAFT (1) Draft gage and a CO_2 indicator are essential to good operation.

(2) Always operate with some draft above the fuel bed—preferably not less than .10 in. The entire furnace, however, should be kept under negative pressure. Plus pressure causes excessive temperatures often with destructive effect on stoker and setting.

(3) Maintain proper air supply at all times. The best indicator is the CO_2 reading. Establish, experimentally, the proper CO_2 reading for *your* conditions and then operate accordingly. Don't guess.

(4) Some air should be allowed to pass through grates at all times. On bank open windbox access doors to admit air for cooling grates.

(5) If draft is insufficient, check leaks in setting and losses through boiler and flue connections; check position of boiler damper. Careful checking will usually disclose conditions that can be improved.

CLEANING (1) Remove siftings from windboxes often enough to prevent any possibility of fire under grates. Frequency of cleaning depends upon type of fuel used, but windboxes should be inspected once every shift.

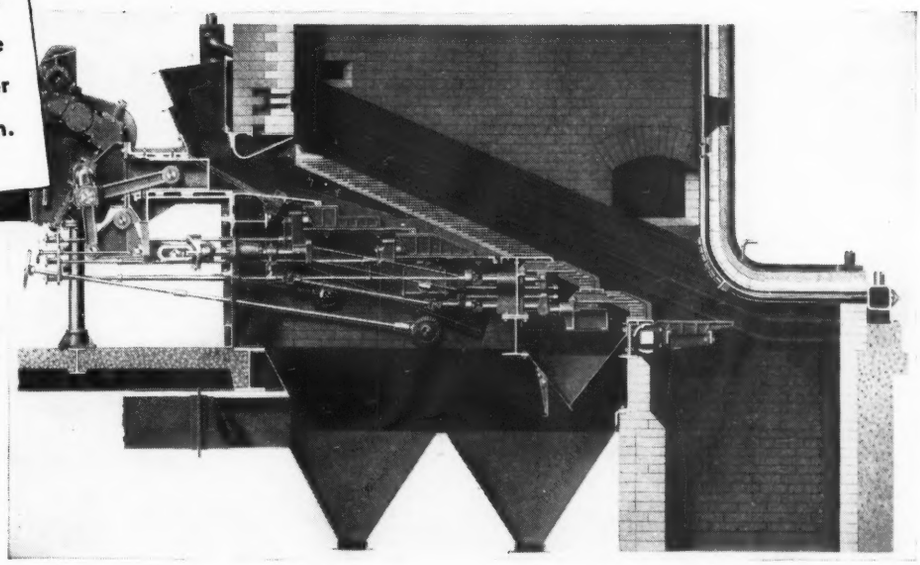
(2) Keep front of stoker clean to prevent contamination of lubricants and excessive wear on moving parts.

INSPECTION AND MAINTENANCE

(1) All accessible parts of the stoker should be inspected daily. Those parts which cannot be examined

RETORT STOKERS LAST LONGER

If this information is not of immediate interest to you, please see that it reaches the proper man in your organization.



C-E Multiple Retort Stoker

while the stoker is in service should be thoroughly inspected at least twice a year and more often if practicable. If conditions permit, it is desirable about once a week, when load is light, to burn down fire on rear of stoker, feed off the refuse and observe condition of lower end of stoker.

(2) On daily inspections, look especially for loose bolts and loose connections in moving parts. Where movement is transmitted by sheer pin, or safety release, be sure there is no binding which might prevent protective device from serving its function. Make repairs or replacements promptly.

(3) When stoker is shut down, make thorough inspection. Check wear on surfaces of retort sides and ram boxes. (If they are allowed to get too thin before replacement, serious outage will result.) Check wear on moving parts, check alignment. Check condition of dump grates and tuyeres.

(4) Check adjusting mechanism that controls secondary rams and overfeed section occasionally to be sure that the actual travel corresponds with indexing plate at front of stoker.

(5) Check stoker dampers in open, closed and intermediate positions. Adjust when necessary.

(6) On clinker grinder stokers check rolls and cutters from time to time. Replace broken or badly worn cutters to assure proper grinding.

(7) Make minor repairs as soon as need is apparent. Keep replacement parts on hand. A serious outage may thus be averted.

LUBRICATION

The use of the right lubricants at sufficiently frequent intervals at all points requiring lubrication is essential if unnecessary outages and excessive maintenance are to be avoided. Difficulties from inadequate lubrication usually result from a lack of attention rather than a lack of knowledge as to how, when and where to lubricate. A definite schedule for lubrication, regularly adhered to, is the answer.

The C-E line of stokers is the most extensive on the market. It includes single-retort, multiple-retort, spreader, traveling and chain grate types.

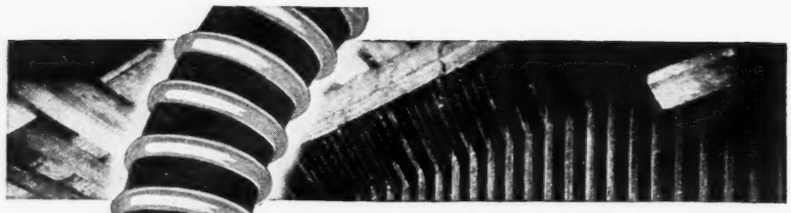
OVER 17,000 C-E STOKERS HAVE BEEN PURCHASED TO DATE

Reprints of this advertisement available on request.

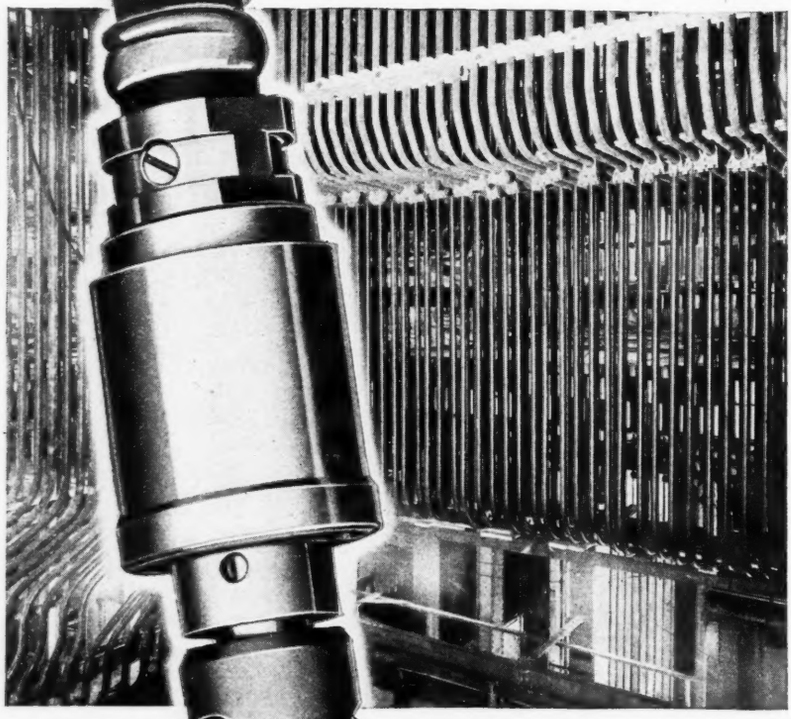
A-696

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N.Y.



What's inside *of the tubes?*



Scale-crusted tube walls don't show—except on the steam gage and the fuel bill. But they show up plenty there. And when they do, a bit of Elliott-Lagonda boiler tube treatment is indicated.

This treatment requires only the inserting of the correct Elliott-Lagonda tube cleaner, turning on the air, steam, or water, and letting the cleaner restore the bloom of youth to inside tube surfaces.

Elliott-Lagonda cleaners are as modern as the design of the boilers or other apparatus whose tubes they clean. All the way from cleaners for straight tubes, to cleaners that can squirm and twist their way through all kinds of tube bends, chewing out the scale like a rat through cheese. All sizes, too.

When you have a tube cleaning job that is making trouble, ask the Elliott-Lagonda people.

ELLIOTT LAGONDA

Cleaners for all tubes

ELLIOTT COMPANY

LAGONDA-LIBERTY Tube Cleaner Dept.

SPRINGFIELD, OHIO

DISTRICT OFFICES IN PRINCIPAL CITIES

Y-185

How to calculate Rate of Heat Flow through Metallic Walls

As a result of work done by INCO Technical Service, a new booklet, "Heat Transfer through Metallic Walls," has recently been printed.

It explains in detail how to calculate heat transfer, and covers conductance values of film, scale, and condensing vapor film. It also includes tables on thermal conductivity of various metals, conductance ranges for metallic walls and films and other phases of the subject.

A valuable section of "Heat Transfer through Metallic Walls" consists of charts on heat transfer co-efficients for 11 different metals:

Copper	Lead
Aluminum (2S)	Cupro Nickel (70-30)
Red Brass (85-15)	Monel
Admiralty Brass	Inconel
Mild Steel (SAE 1020)	Stainless Steel (Type 430)
Nickel	Stainless Steel (Types 304, 316, 321)

In addition to the information contained in this bulletin, INCO Technical Service will gladly furnish personal assistance in the solution of specific heat transfer problems.

For copies of "Heat Transfer through Metallic Walls" please mail the coupon below.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street **New York, N. Y.**

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York, N. Y.

Gentlemen:

Please send me.....copies of your bulletin, "Heat Transfer through Metallic Walls" to:

Name.....

Title.....

Company.....

Address.....

THIS LITTLE TRAP

WRITE FOR

The Armstrong Steam Trap Book, **a valuable guide to good condensate drainage practice. For additional helpful trap maintenance and hookup data, ask for new *Service Guide*.**

ARMSTRONG

is worth annually

10 TIMES ITS WEIGHT IN BOILER METAL

1000 TIMES ITS WEIGHT IN COAL

Based on a saving of only 25 lbs. of steam per hour per trap, the amount of boiler metal necessary to generate this much steam would be as much as ten or more times that used in the trap.

THE fuel-saving, labor-saving, money-saving advantages of Armstrong Steam Traps, important to prosperity in peacetime, have become vital weapons in wartime.

Based on conservative records of steam savings secured by users of Armstrong Traps, it is estimated that 100,000 Armstrong Traps would make the following contributions to the war effort:

SAVE 14,000 carloads of coal in one year of 12 hour days. OR, save the oil carried by 68 5000-ton tankers.

SAVE ten or more times their weight in boiler metal.

SAVE 100,000 man days a year in maintenance and operation alone, with no attempt made to estimate manpower savings made possible throughout a plant where the output of steam-consuming units is increased from 10 to 33% and more.

ADD to these advantages, the increased production, higher temperatures and closer control of processing made possible by Armstrong Traps and you'll agree they are true warriors against the aggressor.

There is an Armstrong Representative near you to discuss your condensate drainage requirements, or write direct.

Sixty-eight 5000-ton tankers would be required to carry the oil that could be saved by 100,000 Armstrong Traps.

•

The amount of coal that could be saved would be the amount carried by a train of 14,000 cars—seven tons per 14 lb. trap!

ARMSTRONG MACHINE WORKS

812 Maple Street • Three Rivers, Michigan

Tested Capacity **STEAM TRAPS**

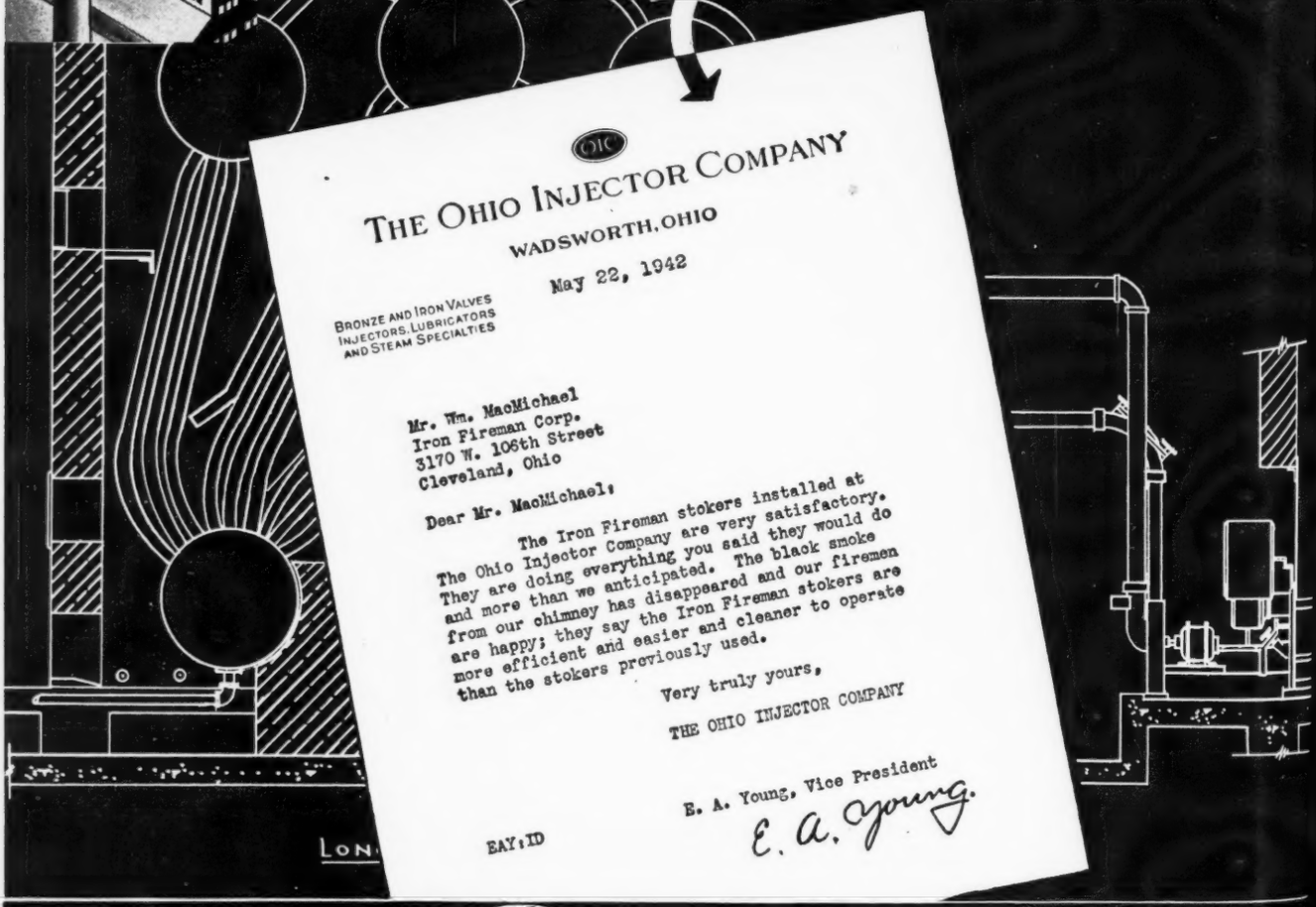
Smoke is Waste!

IRON FIREMAN P.S.

Nuisance at

★

Blueprints of Pneumatic Spreader Installations which Produced these Results



THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

May 22, 1942

BRONZE AND IRON VALVES
INJECTORS, LUBRICATORS
AND STEAM SPECIALTIES

Mr. Wm. MacMichael
Iron Fireman Corp.
3170 W. 106th Street
Cleveland, Ohio

Dear Mr. MacMichael:

The Iron Fireman stokers installed at The Ohio Injector Company are very satisfactory. They are doing everything you said they would do and more than we anticipated. The black smoke from our chimney has disappeared and our firemen are happy; they say the Iron Fireman stokers are more efficient and easier and cleaner to operate than the stokers previously used.

Very truly yours,

THE OHIO INJECTOR COMPANY

E. A. Young, Vice President

EAY:ID

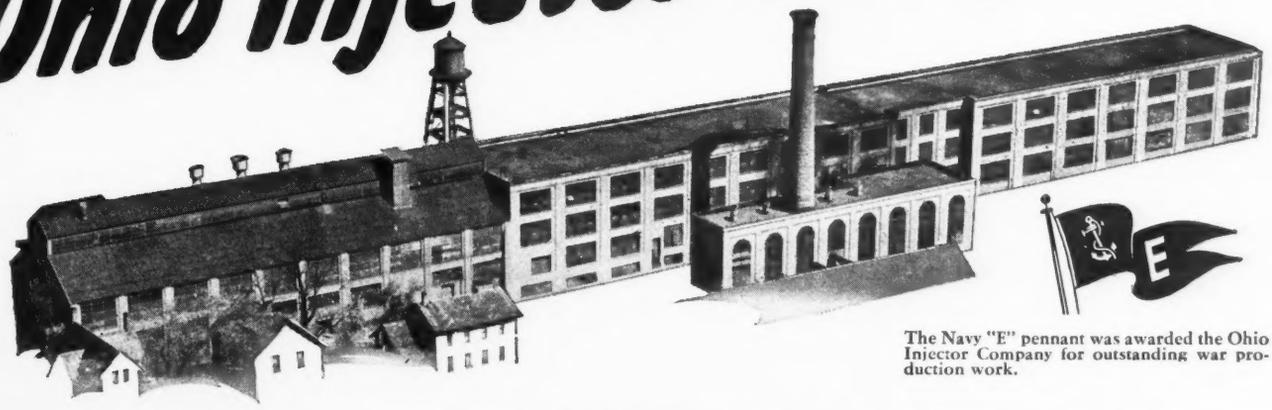
E. A. Young

IRON FIREMAN

THE IRON FIREMAN

Automatic Coal Stokers

STOKERS Abolish Smoke
Ohio Injector Company



The Navy "E" pennant was awarded the Ohio Injector Company for outstanding war production work.

More Power for War Industries

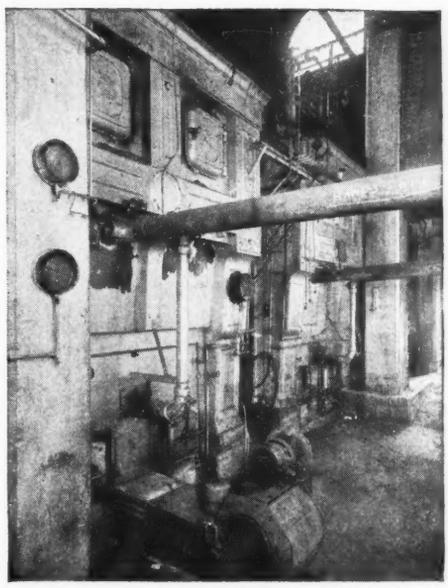
The Ohio Injector Company, well-known manufacturer of high grade valves and locomotive injectors, is doing such an excellent production job that the Navy Department recently honored it with the Navy "E" pennant.

Ohio Injector needed more steam—"plenty, and plenty quick," and Iron Fireman Pneumatic Spreader stokers are doing that big job. In November, 1941, the company installed two P.S. stokers under Stirling water tube boilers, to replace other coal firing equipment which had been responsible for a severe smoke nuisance. The obnoxious smoke situation was cleared up. Then Ohio Injector placed an order for a third P.S. stoker.

Saves Manhours

No coal shoveling is required with the Iron Fireman Pneumatic Spreader bunker-feed stokers, such as were installed at Ohio Injector. In these times when manpower is both scarce and valuable, bunker feed stokers help to win the production line battle.

E. A. Young, Vice President, the Ohio Injector Co., reports that the stokers save $6 a day in labor costs, alone. There have been no stoker maintenance costs.



Ohio Injector installation. In the foreground is the quiet, efficient fan for supplying forced draft to fire, and the volumeter which maintains exactly the amount of air needed for proper combustion.

Keeps Boiler Room Clean

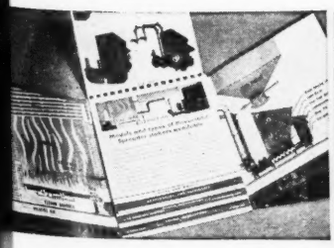
Iron Fireman keeps the boiler room clean, because the coal is transported in overhead pipes to the boiler front, and into the furnace. Mr. Young reports, "When the Iron Fireman P.S. stokers were installed we painted the boilers aluminum, and the boiler room walls have been painted white.

"The boiler room has been changed from a dirty, dusty dungeon into a clean, pleasant place to work."

A clean, pleasant boiler room keeps employee morale high.

See P.S. Stokers at Exhibit

See our exhibit at the 15th National Exposition of Power and Mechanical Engineering, Madison Square Garden, New York, November 30 to December 4, 1942.



FREE BOOK on Pneumatic Spreader Firing

Contains full descriptions, capacities, operating data, etc., with layouts and photos of 10 actual installations. Sent free, on request. Write to Iron Fireman Mfg. Co., 3312 W. 106th Street, Cleveland, Ohio.

EVERY War Bond you buy helps preserve the freedom for which the Statue of Liberty stands.

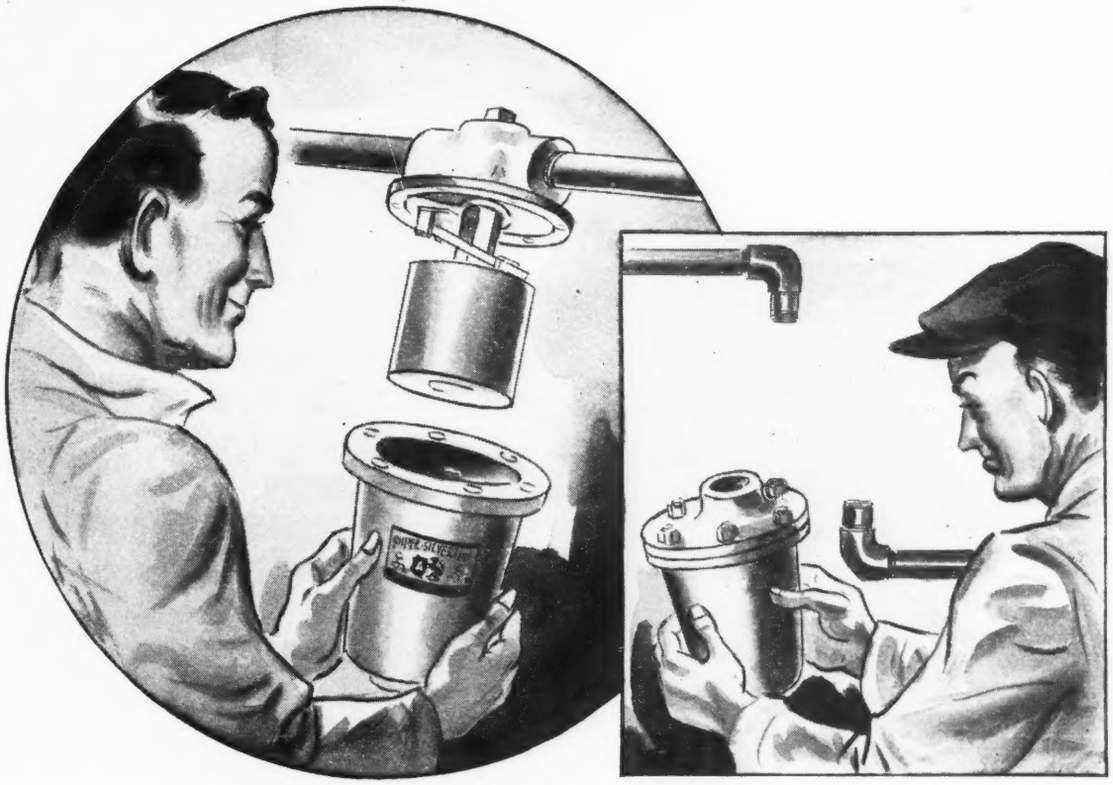
Buying *quality* products brings Victory closer, too. The uniform high quality of *Garlock* packings, gaskets and oil seals is helping thousands of industrial plants maintain full production at top-speed, war-time efficiency.

GARLOCK

THE GARLOCK PACKING CO.
PALMYRA, N. Y.

In Canada:
The Garlock Packing Co.
of Canada Ltd., Montreal, Que.

wartime maintenance no problem for SUPER-SILVERTOP USERS



The vital necessity of keeping power flowing makes steam trap maintenance an important subject today. Now, when steam-using equipment is being called upon to deliver maximum war work, steam traps must be inspected regularly, kept clean and in efficient working condition. With Super-Silvertop Steam Traps inspection and maintenance is no problem.

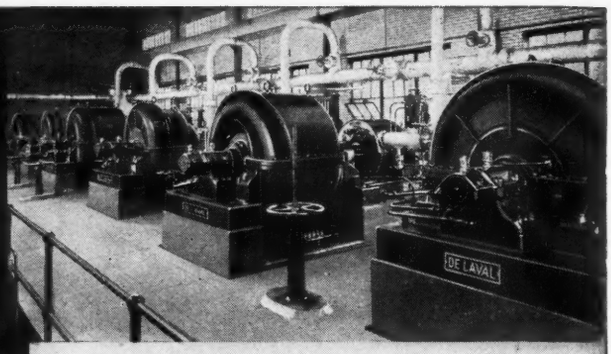
The Super Silvertop user finds that by releasing a few bolts he can remove the casing, inspect his trap, and clean or replace parts, all *without removing the trap from the line.* Compare this saving in work and lost time with that of a trap that has to be removed completely from the line for maintenance or inspection.

More than that, remember that Super Silvertops are installed either straight-in-line or as an elbow with a saving of 60 minutes per trap and using from 6 to 13 parts less. Send for the book "How To Choose A Steam Trap" giving complete details on steam trap selection, installation, operation and maintenance.

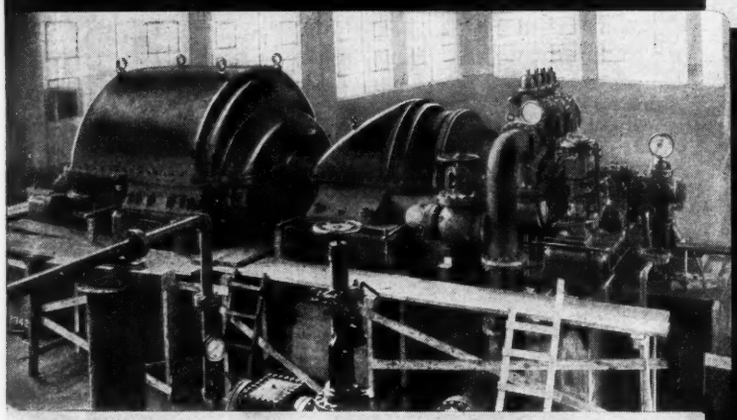
THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland, Ohio

Super-Silvertop
STEAM TRAPS

For Air and Gas Blowers, Compressors and Exhausters *Consult* DE LAVAL



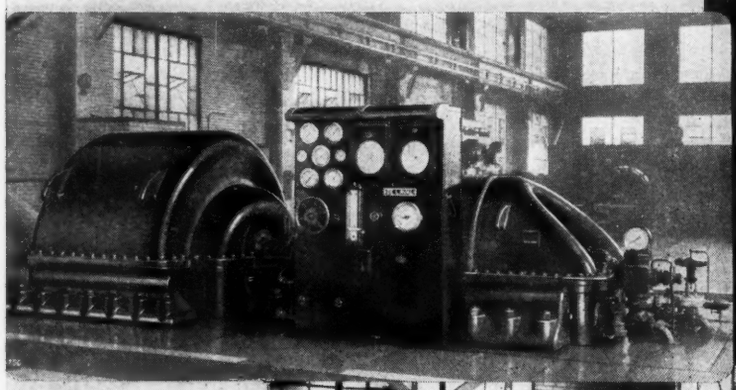
Six De Laval turbine-driven exhausters and boosters in a coke-oven plant. Three are rated at 31,365 c.f.m. each, two at 18,600 c.f.m. each, and one at 25,200 c.f.m.



A 115,000 c.f.m. turbine-driven compressor on test at the De Laval Works.

During recent years numerous repeat orders for De Laval air and gas handling equipment have been entered by large blast furnace plants, by-product coke-oven operators, and domestic gas works. In constructing both the steam power and gas ends of these machines, and also the controls, advantage has been taken of the latest improvements in design and in materials, and their satisfactory operation is testified to by the fact that the users come back to De Laval again as needs expand.

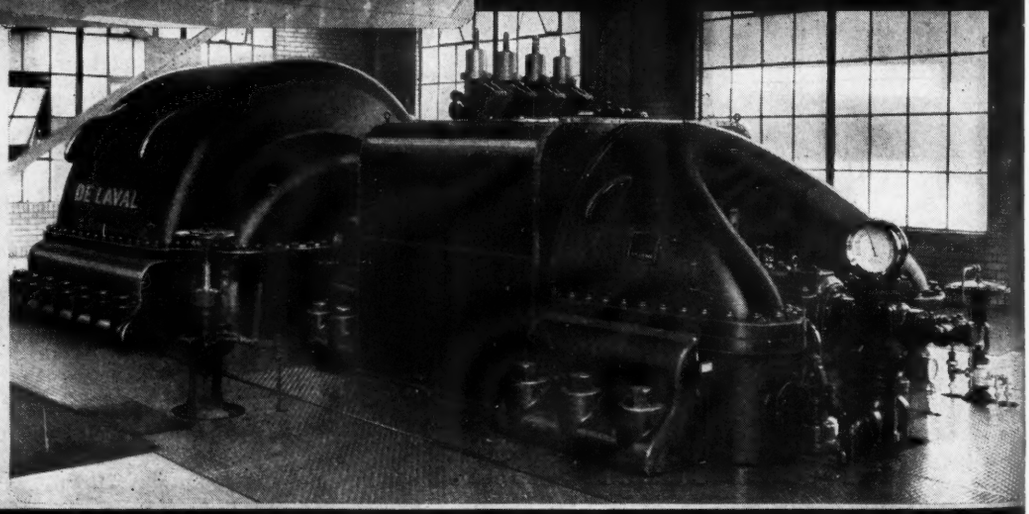
Ask for Catalog F-3824, which contains tables, charts and instructions for the solution of gas handling problems.



75,000 c.f.m. unit installed earlier in same plant and for same conditions as 85,000 c.f.m. blowers shown below.

• • •

Turbine-driven blast furnace blower; 85,000 c.f.m. of air against 30 lb. at 2800 r.p.m.; turbine using steam at 400 psig and 700° F.



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VOLUME 86, No. 12

STEAM GENERATION
POWER GENERATION
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POWER

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DECEMBER, 1942

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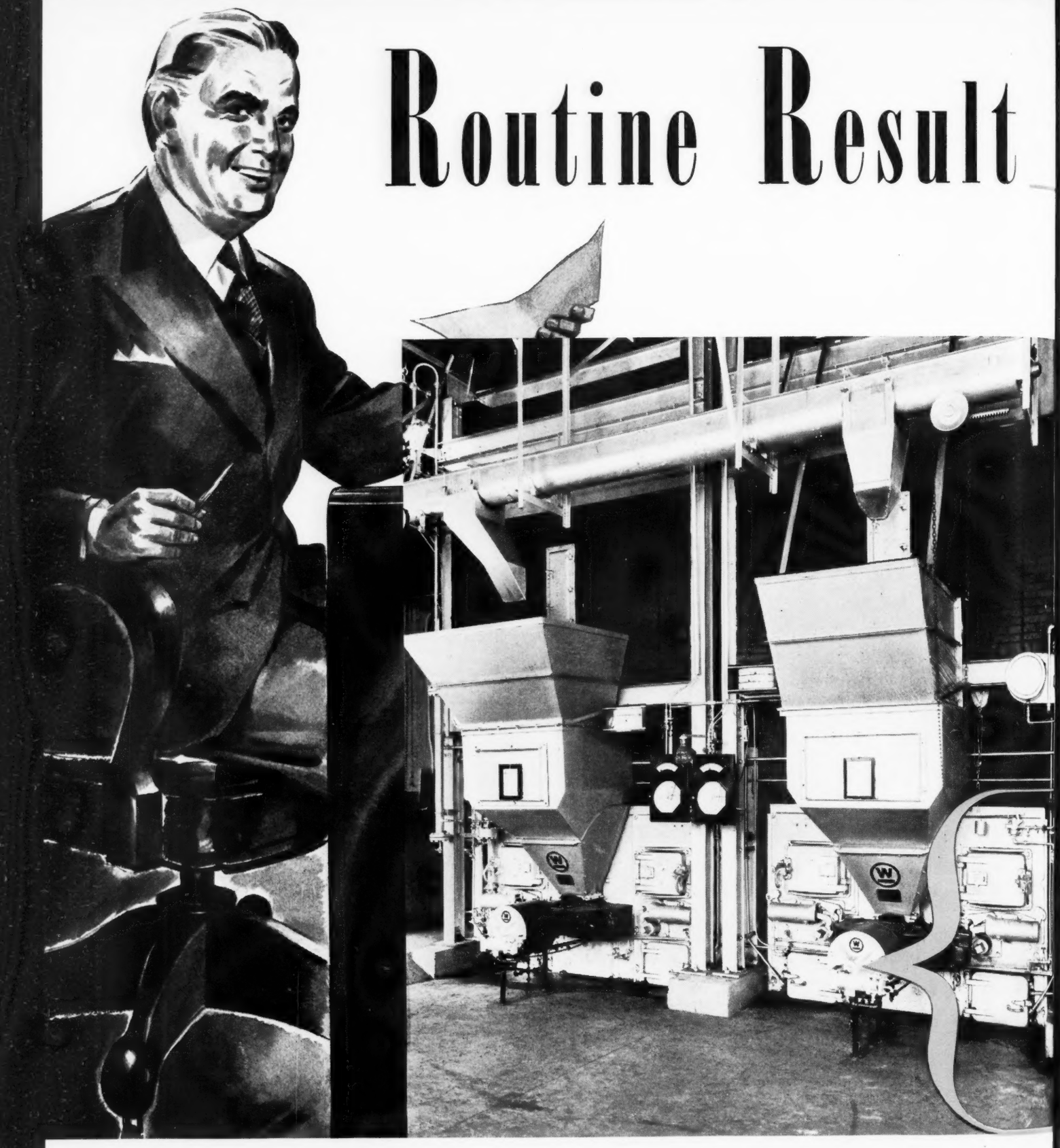
Routine Result



Complete three-and-one-half year service period at Louisville City Hospital required only $150 worth of replacement parts for these two stokers serving 276 HP and 295 HP boilers. Average fuel consumption: 6200 tons of East Kentucky coal per year. Stokers are operated in continuous service periods up to four months without shutdowns.

fuel savings paid for stokers in 2 years

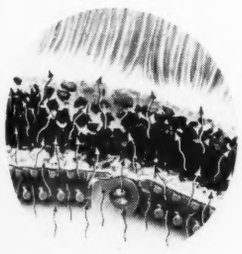
Louisville City Hospital, Louisville, Ky., reports cash savings in fuel costs alone over a two-year period were more than enough to write off the original investment in two single retort Link-Grate Stokers. This record isn't unique. Similar fuel savings have been experienced by Link-Grate users in more than forty different classifications, from hospitals to central stations, from small factories to largest process industries. How does the Link-Grate Stoker give these important savings?

Link-Grate Motion is the fuel saver! No matter what grade of bituminous coal is available, you can burn it effectively on a Link-Grate Stoker. Controlled, continuous motion of the grates processes the fuel bed, keeps it porous and reduces thin spots.

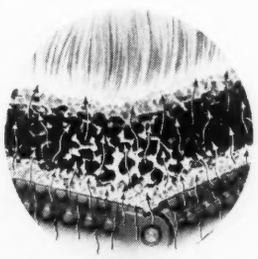
Air-Diffusing Design of grates assures thorough permeation of the fuel bed with low-pressure air for high combustion efficiency. Large volumes of air can be admitted to the fuel bed, but there is little tendency to blow through. At the same time, this continuous flow of air effectively cools the grates.

All of these factors add up to high daily fuel economy over the long pull. J-50417

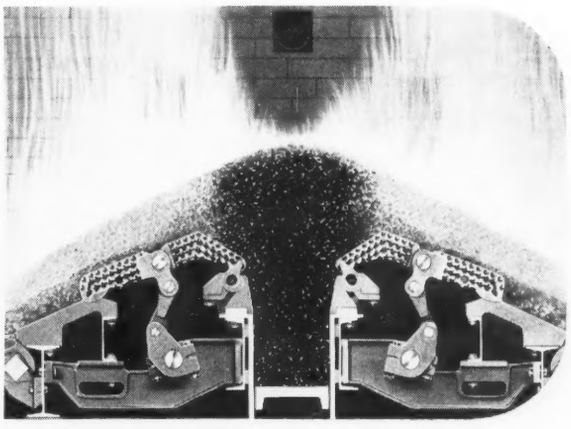
here's how the Link-Grate works



GRATES UP—Fuel bed broken, thoroughly permeated with low-pressure air. Fused ash oxidized, clinkers broken into small, friable pieces.



GRATES DOWN—Fuel bed made porous for uniform flow of gases throughout entire combustion zone—continuously conveyed towards the dump grates.



see Link-Grate Stokers in operation. Talk with operators and management. Get the performance facts, the economy figures. A Westinghouse representative will arrange a visit. In the meantime, send for these interesting Link-Grate factbooks: Bulletin 3039 (multiple retort), 2196-A (single retort). Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

Westinghouse

For maintenance men who aim to DO IT RIGHT with what they have

BYERS WROUGHT IRON

Welding Byers standard Wrought Iron Pipe in the discharge end of an inter-cooler. The equipment handles gas which enters at 270°F., and leaves at 100°. River water is used for cooling. Wrought iron was chosen because corrosive attack, aggravated by vibration, had caused premature failure of ordinary materials.

Every plant has heat exchangers of one form or another, and periodically repairs or replacements must be made. Right now, new exchangers are hard to get . . . and obtaining corrosion-resisting OD tubing often involves delays because the material is special and the quantities are small.

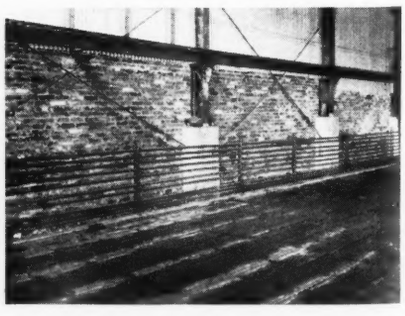
If you have such a problem—and will permit a suggestion—why not investigate the possibility of using wrought iron *STANDARD PIPE* as tube replacements? Your own stock-room may be able to provide it. It has been proved in hundreds of highly corrosive condenser services, where sea, river and well water were used for a coolant, and where not only steam but all sorts of process liquids were handled, so its usually long life is a matter of engineering record. This eliminates the threat of early repairs and replacements, which would further drain the limited supply of critical metals.

When 3½", or 4" OD tube is involved, 3" and 3½" wrought iron pipe can be substituted without adjustment, as the overall dimensions are identical. In the case of smaller tubing, the substitution of pipe requires the reaming of the crown-sheet hole to slightly larger size . . . or the use of a ferrule. Ferruling introduces no new practice, for it is generally necessary even with OD tube, where the condenser has been several times repaired.

If you would like to investigate the possibility of using genuine wrought iron pipe for re-tubing, we will be glad to send you a data sheet, showing relative dimensions.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

The useful life of wrought iron isn't always expended in its first job. Plates from this 50-year-old stack were re-rolled, and are now in their 4th year of service in a new location.



Using what you have is smart—and patriotic—today. This engineer utilized 40-year-old wrought iron coils from an abandoned brine-tank for these heating lines.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

STEEL TUBULAR PRODUCTS

HANDBOOK OF PIPING MAINTENANCE

Practical pointers on maintaining pipe, joints, valves, traps, supports, and insulation . . . By P W Swain and E W Feller

AT THE VERY CORE of the power engineer's job lie piping systems—a vast arterial network conveying steam, water, air, refrigerant, brine and other power fluids. Maintenance of these systems, always a major responsibility both in central stations and in industrial plants, has been made crucial by the War.

On the one hand, today's production schedules demand an uninterrupted flow of essential fluid services. On the other, this never-ceasing service must be maintained despite shortages of repair parts, supplies and basic replacement elements. Like the Children of Israel in Egypt, today's engineers must "make bricks without straw" to keep industry's wheels turning, and no excuses will be accepted.

It was inevitable that POWER's series of special sections should eventually include this Handbook of Piping Maintenance—and fortunate that its publication could be timed to serve the special needs of a war economy. With the present situation always in mind, the section stresses the more homely aspects of piping maintenance, but the whole story, including the "higher branches," is here as far as space permits. Without neglecting the piping for extreme high-pressures, emphasis falls on the medium and low-pressure lines that constitute the great bulk of piping mileage in American industry. This Handbook will serve the power engineer equally well in the coming days of peace, for maintenance problems will always be with us.

Cure Major Troubles First

First step in any piping maintenance program involves eliminating, as far as possible, basic conditions that make excessive maintenance necessary. These may include severe corrosion, water hammer, or poor piping layout. In the case of both corrosion and water hammer little can be done until one understands the cause. Here are some practical tips that may help:

Probably the biggest single piping-maintenance problem is corrosion. Books have been written on the theory, but the practically important point here is that internal corrosion of piping is generally caused by atmospheric oxygen dissolved in water, and stops when oxygen is removed or used up by its attack on the metal.

Water coming into a system from the outside is always saturated with oxygen, and will continue to corrode the piping until the oxygen is consumed in the process. That is why service-water lines (always supplied with new water and new oxygen) rust faster than hot-water heating lines, which constantly recirculate the same water.

In the steam-water circuit of power plants, dissolved air (oxygen) enters through the makeup water and through leaks into parts of the system under vacuum. The accepted cure is to minimize all such leaks by joint and packing maintenance and then deaerate the feedwater in a suitably designed heater. Sometimes sodium sulphite is used to remove the last traces of oxygen.

Corrosion of condensate lines of heating systems is usually caused by air getting in (through vents, reliefs and joints) at points where the system is under vacuum.

External corrosion may be rapid where pipe is frequently wet from "sweating" or other moisture—and particularly if the wet surface is repeatedly exposed to air containing sulphurous or acid fumes. To cure it, remove the cause or waterproof the pipe. Pipe buried in cinders or soil will often corrode, particularly if the soil is damp and acid. A practical protection is a watertight covering, generally of asphaltic material applied directly to the pipe or in a spiral wrapping of strong fabric.

In normal times pipe with perforations or cracks from corrosion or other causes would be replaced at once. Where

this is not possible because of war conditions, emergency patches, like those shown on this page and elsewhere, may save a shutdown.

These apply mostly to iron and steel pipes. U. S. Navy practice for a substantial brazed repair of leaking copper or brass pipe is as follows: Shape copper patch to fit. Clean the mating surfaces with file, emery cloth and hydrochloric acid. Wire patch securely in place. Brick in an enclosure to confine the heat. Heat with acetylene torch, but don't burn patch or piping. Run in spelter solder (with borax flux) between surfaces. Keep turning pipe back and forth so spelter will run between all parts of braze. When patch is cool, test with water pressure.

A small hole in brass or copper pipe may be closed with a rivet or screw plug. Small weak areas may be temporarily reinforced by tightly wrapping with wire thoroughly soldered together in layers to make a solid band.

Water hammer occurs when a moving column of water in a pipe is suddenly stopped or retarded. If the cause is too sudden closing the cure is either a mechanical speed limit on the valve or a tag urging cautious handling.

Where a pipe is being constantly hammered by connected reciprocating equipment, anchor firmly and try relieving the shock by air chambers, surge tanks or similar devices.

Drainage

Failure to remove condensate from steam lines is a major cause of water hammer. Drain all condensate pockets. Make sure that traps are operating and that no pipe sags so far as to create a pocket. Watch out for condensate caught above closed valves in vertical lines or back of globe valves in horizontal lines.

If water hammer occurs only when steam is admitted to a cold system it indicates that the system is not adequately pitched or trapped to take care of the large initial condensation. Gradual preheating may ease the situation. Where water hammer has continued for some time, inspect pipe guides, anchors and adjacent walls for serious cracks.

When the more obvious ills of a system have been fixed it is time to set up an orderly maintenance procedure to forestall future trouble. In piping, as with other equipment, proper maintenance means *preventive maintenance*—fixing things before they break. That, in turn, implies organization, records, and definite inspection schedules.

The starting point should be a complete set of drawings of the piping system on which changes and repairs can be noted and dated as made.

Organization

It is not enough to be a good piping mechanic, important as that is. Failure to *organize* maintenance can cause a lot of trouble and unnecessary expense. Complete drawings of the system, with all changes and corresponding dates indicated, will repeatedly save ripping out this or that piece to rediscover facts that should be in the office files. Moreover recorded installation dates on piping elements will warn the experienced maintenance engineer when trouble may be expected from the everyday causes that lead to piping failure.

When a leak occurs the adjacent piping should be studied to locate anything else that needs fixing, so that the whole job may be done at one time. If the hookup is deficient in unions, or otherwise difficult to maintain, the situation should be remedied while making necessary repairs.

General routine inspection should check leaks, look for signs of corrosion, or weakness, make sure anchors are holding and expansion joints working freely, check hangers for alignment and distribution of load.

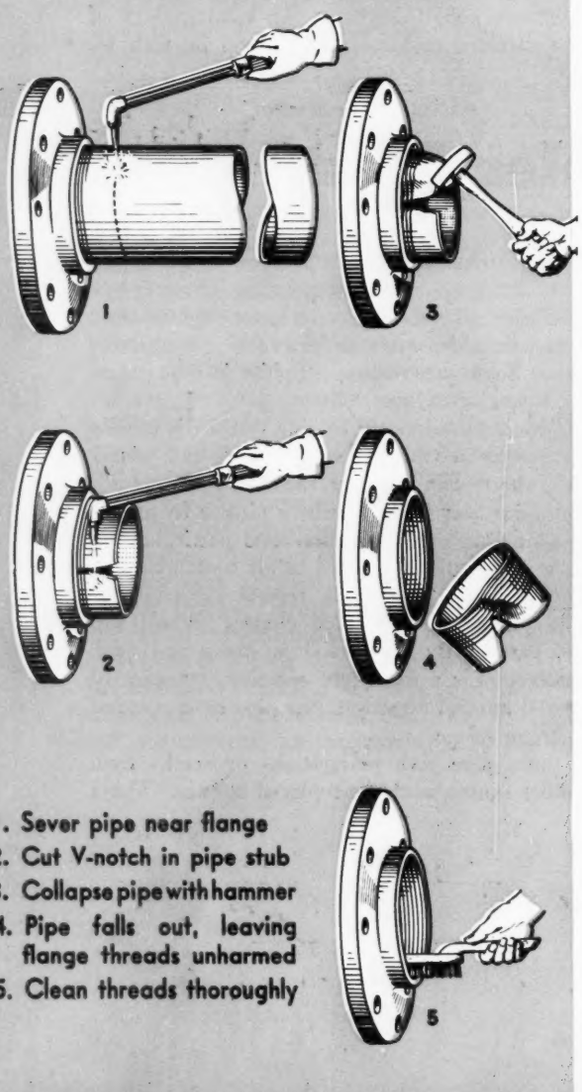
Temperatures

Inspection of an old system should consider any increased pressure or temperature since installation because these may exceed the safe limits of the materials installed. The ASA Code for Pressure Piping sets the following upper temperature limits:

Cast-iron fittings and pipe, 450 F; malleable iron, 500 F; copper and brass pipe and tubing, 406 F; bronze and brass fittings and valves, not over 350 F; carbon cast-steel fittings, valves and flanges, 750 F. Certain special alloys may be used up to 950 F.

In the articles that follow will be found many practical suggestions for the maintenance of joints, valves, traps, supports, anchors, guides, insulation and other piping elements.

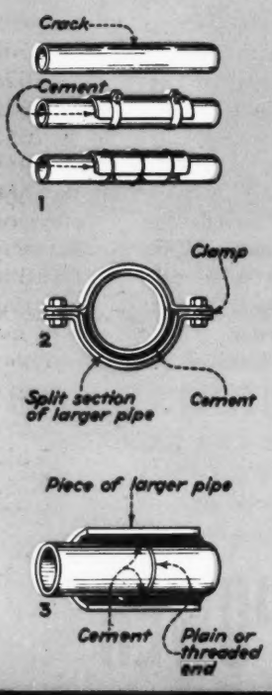
IF THREADS FREEZE, TORCH CUTTING WILL SALVAGE THE FLANGE



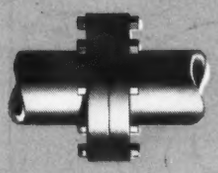
1. Sever pipe near flange
2. Cut V-notch in pipe stub
3. Collapse pipe with hammer
4. Pipe falls out, leaving flange threads unharmed
5. Clean threads thoroughly

EMERGENCY PIPE-REPAIR OPERATIONS

1. To seal pipe crack apply iron cement and bind it tight with a metal sheet. 2. Clamp on a half-shell cut from next larger pipe size and seal with cement or soft gasket. 3. For an emergency pipe joint slide ends into larger pipe and calk with iron cement



JOINTS



Clean-Cut Threads Make Tight, Long-Lived Joints

ANY DETAILED DISCUSSION of piping maintenance must start with the practical art of pipe threading for two reasons: First, badly made threaded joints increase maintenance and endanger plant operation; second, the pipe maintenance man is always a piping erector to some degree.

Good threaded joints are mainly a matter of making good threads. These, in turn, require a clear understanding of the proper shape and dimensions of the desired thread and of the die or cutting head that forms it.

A brief review of the general scheme of standard American pipe and thread dimensions may bring out certain points often overlooked. Pipe 14-in. or larger is named by its actual outside diameter. Usual "OD" sizes are 14, 16, 18, 20, 24, 30 in.

Pipe Data

For 12-in. and smaller, the nominal pipe size is very roughly the *inside* diameter of so-called "Standard" pipe. The two heavier series called "Extra Strong" and "Double Extra Strong" have the same external diameters but smaller internal. These traditional names will eventually be displaced by the new and more logical nomenclature of the American Standards Association, which sets up a series of pipe "schedules," "10", "20", "40", "60", "80", "100", "120", of progressively increasing thickness to cover the great variety of modern conditions. For pipe sizes up to 8 or 10 in. the new "Schedule 40" is identical with "Standard"; "Schedule 80" with "Extra Strong."

The complete size schedules and other specifications for piping are contained in the ASA Code for Pressure Piping, obtainable from the ASME, 29 West 39th St. New York, N. Y. The dimensions of Schedules 10, 20, 30, 40, 60, 80, 100, 120 are listed in POWER's Data Sheets 121, 122, and 123 along with the maximum pressures permissible for various temperatures.

Regardless of "weight" or "schedule", pipe of a given nominal size follows the outside and thread dimensions shown here under the title "American Standard Pipe Threads."

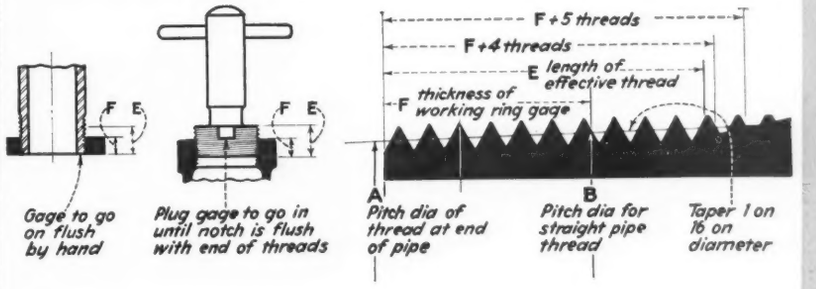
Note that 2½-in. and all larger pipe runs eight threads per inch. In all pipe sizes threads are 60-degree vee, with the *vee* square with the center line of the pipe. The thread is tapered 1 to 16 (measured on the diameter) at ¾ inch on the diameter per running foot.

Top and root of each thread are flattened by cutting off 1 30 of the height at both ends. Net remaining height is 0.8 times pitch. Pitch is 1 divided by number of threads per inch. *Thus, for 2½-in. pipe and all larger sizes, pitch is* $1 \div 8 = 0.125$; *net thread height is* $0.8 \times 0.125 = 0.100$ *in.*

Most threads are cut with a set of four or six chasers mounted in a hand die or a machine-operated head. Following comments refer to sketches at the top of next page. Angles are important, and Fig. 1 shows lip rake and cutting angles. Note that the cutting angle equals the lip angle only when the face of the chaser lies along a diameter of the pipe. If the chaser is not in this position, allow for it when grinding lip angle.

Since the chaser acts much like a

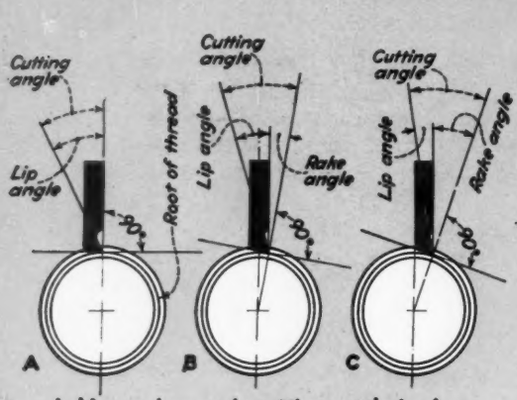
AMERICAN STANDARD PIPE THREADS


F
E
F
E
F + 5 threads
F + 4 threads
E length of effective thread
F thickness of working ring gage
A
B
Gage to go on flush by hand
Plug gage to go in until notch is flush with end of threads
Pitch dia of thread at end of pipe
Pitch dia for straight pipe thread
Taper 1 on 16 on diameter

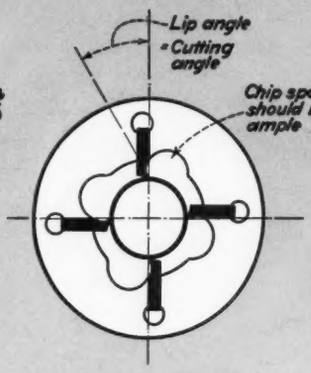
Nominal pipe size	External diameter, in.	Threads per inch	Depth of thread, in.	Pitch of thread, in.	SEE SKETCH A	B	E	F
⅛	0.405	27	.030	.037	.364	.374	.26	.18
¼	0.540	18	.044	.056	.477	.489	.40	.20
⅜	.675	18	.044	.056	.612	.627	.41	.24
½	.840	14	.057	.071	.758	.778	.53	.32
¾	1.050	14	.057	.071	.968	.989	.55	.34
1	1.315	11½	.070	.087	1.214	1.239	.68	.40
1¼	1.660	11½	.070	.087	1.557	1.583	.71	.42
1½	1.900	11½	.070	.087	1.796	1.822	.72	.42
2	2.375	11½	.070	.087	2.269	2.296	.75	.44
2½	2.875	8	.100	.125	2.719	2.762	1.14	.68
3	3.500	8	.100	.125	2.341	3.389	1.20	.76
3½	4.000	8	.100	.125	3.838	3.889	1.25	.82
4	4.500	8	.100	.125	4.334	4.387	1.30	.84
5	5.563	8	.100	.125	5.391	5.450	1.41	.94
6	6.625	8	.100	.125	6.45	6.506	1.51	.96
8	8.625	8	.100	.125	8.43	8.500	1.71	1.06
10	10.750	8	.100	.125	10.55	10.621	1.93	1.21
12	12.75	8	.100	.125	15.533	12.618	2.13	1.36

Note: Pipe sizes 14, 16, 18, 20, 24, 30 in. are actual outside diameters and run eight threads per inch

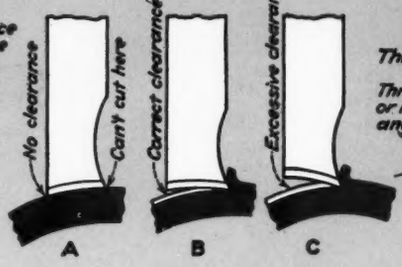
CORRECT CHASERS MAKE GOOD THREADS



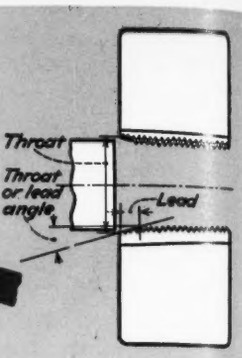
1. Lip angle equals cutting angle in *A*. Otherwise (*B* or C), make allowance for rake angle in grinding the lip angle



2. Typical threading die with four chasers and ample pockets for chips



3. Excessive heel clearance is the cause of wavy threads. Too little clearance makes cutting difficult



4. Cutting edge of lead does heavy work of starting thread

5. Ends of set of chasers showing leads ground to distribute cutting equally

lathe tool, we find similar variations in cutting angle. Cutting angle should be very small for brass, not over 16 deg for wrought iron, from 15 to 20 deg for Bessemer pipe and at least 25 deg for open-hearth pipe.

Heel clearance (Fig. 3) is formed in the chaser threads at the factory and cannot be altered or restored with maintenance tools. Clearance reduces as the front part of the chaser wears away with long use. The only cure is a new set.

To get the chasers well started on the pipe they are beveled at the entrance end with a heavy "lead" angle (Fig. 4) to a diameter larger than the end of the pipe. Fig. 5 shows the lead ends of four successive chasers from the same head. The lead angle is the same in all four, but the cutting edge of each is advanced a little over the next one so that the cutting load is distributed evenly. Maintaining this equal cutting by proper grinding is a matter of first importance.

Fig. 6 shows how to grind the lip angle on a narrow chaser such as is used in a hand die. This method (using the side of the wheel) is not suitable for the wide, flat chasers used in machine-threading heads. These can be ground on a surface grinder, (Fig. 7) or equivalent rig.

Proper grinding of the lead requires the fixture shown in Fig. 8 (or equivalent) in which the table can be turned about either horizontal or vertical axes to give universal adjustments.

Before grinding chaser leads arrange them in serial order 1, 2, 3, 4. Test angles of fixture to make sure wheel bears squarely on existing face of metal to be ground. Then take chasers in rotation and remove same amount of metal from each. If any in the set is then found to be insufficiently ground, start back with number one and give each an equal additional grinding. This even treatment should be watched and tested to make sure each chaser carries its share of the cutting load.

Following are troubles sometimes met in hand and machine threading, and their cures:

Hand Threading

WAVY THREADS

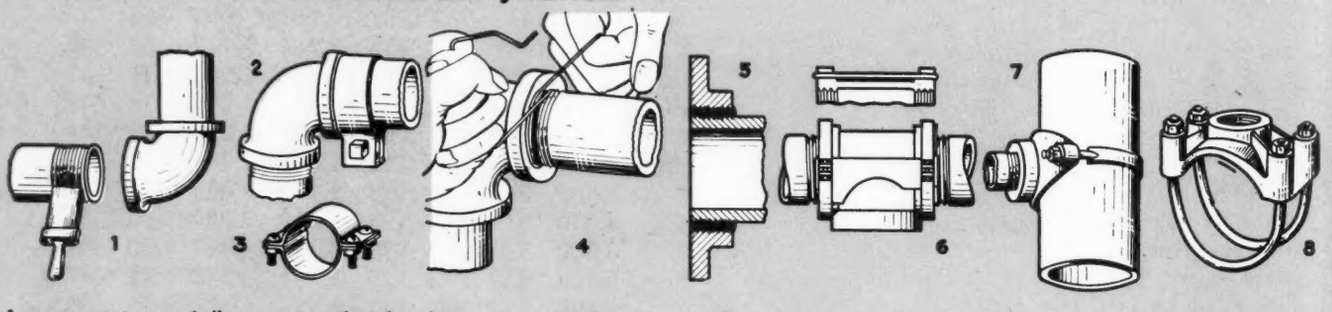
Thumb screws loose and die not set true: Center die. Tighten thumb screws with a *wrench.*

Pipe ends not square: Cut off poorly threaded end. Trim pipe square. Rethread.

Worn-out lead screws: Get a new die.

Cutting or dirt in slot, forcing chasers away from cam and causing unequal cutting: To test, run 75% of thread, then back off fraction of turn to see if chips are equal. If not, clear slots and clean.

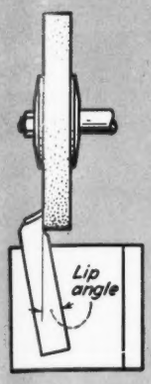
FIRST AID FOR THREADED JOINTS



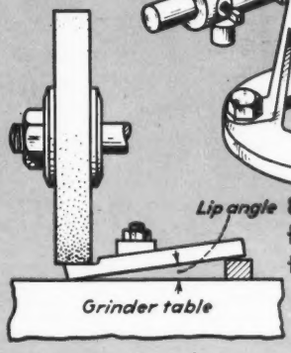
Iron cements specially compounded for the service may be applied as paste or putty to seal pipe joints and cracks. Cement used thin makes a good new-thread dope (1). For best results leaking joint should be *remade* with cement; otherwise cement can be calked under pipe clamp (3) alongside leaky thread (2). Another thread-leak repair involves winding soft wire (4) around cement putty at leak.

Allow cement to harden before using. In emergency, a threaded pipe may be cemented into a flange of larger pipe size (5). Tamp cement solidly in place. (6) shows crack in fitting sealed with cement backed by metal plate. Outlet saddles for water (7) and steam (8) are clamped to pipe over drilled holes to make emergency branch connections. Saddles may be packed with soft gaskets or cement

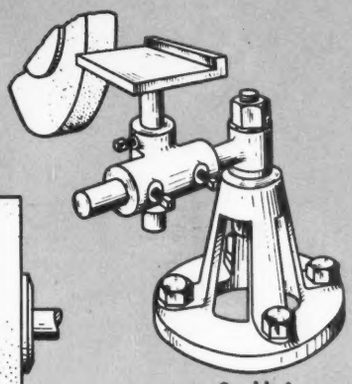
HOW TO GRIND CHASERS



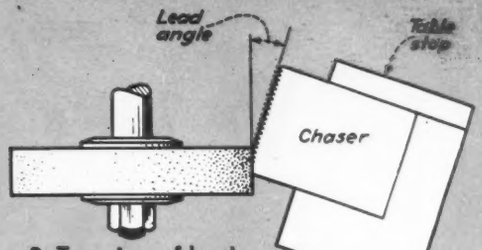
6. Grinding the cutting edge of a narrow chaser from hand threading die



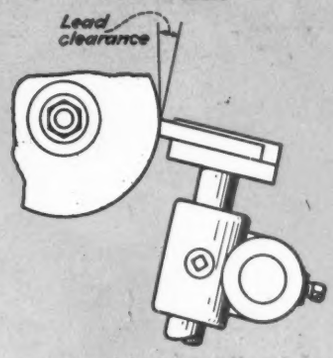
7. To grind lip angle of wide (machine) chasers, traverse with the edge of wheel on a surface grinder or special fixture



8. Universal fixture for grinding leads on thread-cutting chasers



9. Top view of lead-grinding operation



10. Side view of lead-grinding operation

SHAVED THREADS

Chasers out of line: Chip or dirt keeps chaser from bottom of slot so chasers don't "track." Clean it.

ROUGH, CHEWED THREADS

Dull chasers: Sharpen lip and lead bevel.

Lack of lubrication: Use sulphur-base threading oil with lard oil.

Die out of round: Caused by chip between chaser and wedge. Test by threading 75% then backing a little and comparing chip size on chasers. Clean wedges.

Improper lead: Check chaser. Regrind if necessary (see text).

Excessive lip angle: Regrind.

Broken tooth in chaser: Better grind broken tooth completely away.

SHOULDERS ON THREADS

Pipe end not cut square: Cut off threaded end square and rethread.

PARALLEL THREADS (NO TAPER)

Chasers sticking: Clean to remove dirt or chips that may jam chasers. Also make sure that chasers don't fail to recede because lip angle is excessive.

Machine Threading

WAVY THREADS

Loose chasers, caused by old age and wear: Get a new die head.

Worn cam in die head, throwing one or more chasers off true circle: Test by running thread 75%, backing off slightly and seeing if all chips are equal. Cure is a new die head.

SHAVED THREADS

Chaser out of line, so threads don't "track": Clean out chip or dirt to allow chaser to go to bottom of its slot.

Carriage travel retarded: Repair machine so carriage will move ahead at same advance as thread to avoid planing off threads already cut.

ROUGH THREADS

Dull chasers: Sharpen, same as for hand threading.

Insufficient lubrication: Make sure lube system is not clogged. Use good sulphur-base threading oil plus lard oil.

Die out of round: May be due to worn cam or dirt between cam and chaser. Check by seeing whether chasers take unequal chips. Cure depends on type of machine.

Improper lead: Check and regrind as explained in text.

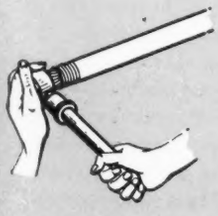
Improper lip angle: Check and regrind as explained in text.

Broken tooth in chaser: Remove entire tooth by grinding.

SHOULDERS

Misalignment: Check and realign machine and die.

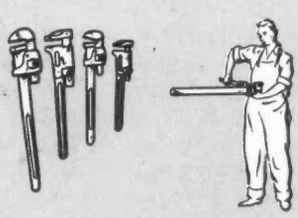
DO'S AND DONT'S FOR PIPEFITTERS



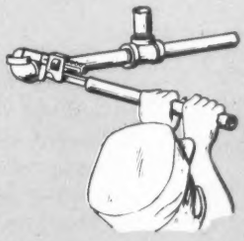
Be sure to ream out burrs that impede flow and sometimes damage equipment

Blow dirt and sand from pipe before making up joints; foreign matter may score valve seats

Apply dope on male threads only to keep it from getting into pipe and equipment

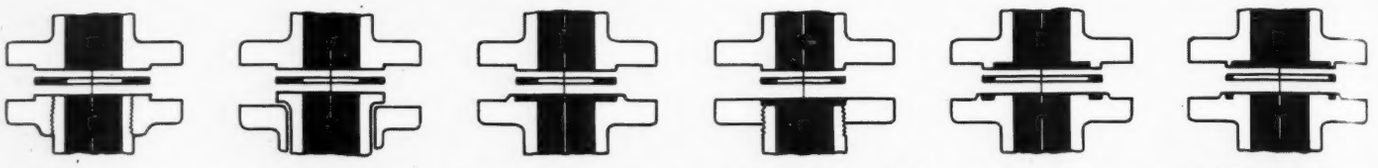


Use right-size wrench; too much leverage may twist valve bodies or crack cast fittings

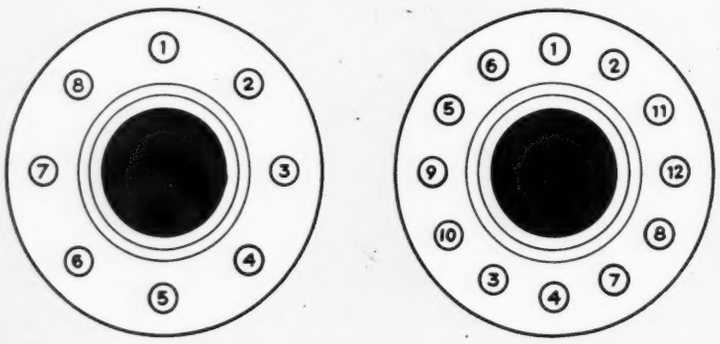


Never use a hickey except to *break* a stubborn joint in taking down a line

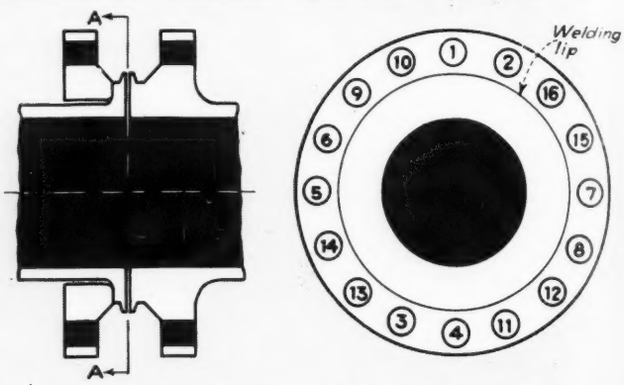
STANDARD CAST-STEEL FLANGES



CORRECT TENSION AND TIGHTENING METHOD MAKE GOOD JOINTS



Two sequences of bolt tightening: In either case, first set nuts finger tight. For method at left, tighten nuts moderately in order 1, 2, 3, etc. Then make another round to set bolts a little tighter — and so on until bolts are equally and sufficiently tight and feelers show equal flange separation all around. Many prefer cross-over method (right)



Bolt tightening for seal-welded joint: First put in temporary bolts all around, hammer tight. Remove 1 and 2, seal weld there and replace temporary with alloy bolts set up hammer tight. Repeat this operation at 3 and 4, 5 and 6, etc., criss-crossing as shown. Follow same general procedure for a different number of bolts, criss-crossing as before

Well-Made Flange Joints Ease Maintenance Work

FLANGES ARE DESIGNED to make life easy for the maintenance man by insuring a tight joint that can conveniently be broken for piping changes and repairs. Yet poor selection of flanges, bolts and gaskets, plus careless joint makeup, can cause endless trouble.

Once the desired face has been selected (see dwg above), flange dimensions and materials are established by the ASA Standard Code for Pressure Piping, mentioned in the previous article. This Code limits cast-iron fittings to 450 F, malleable to 500 F, cast carbon steel to 750 F. Special "carbon-moly" and certain other alloy steels are allowed up to 950 F.

The customary flange bolt for low pressure is square headed with a hex nut and "American Standard Coarse Thread Series" threads. Above 160 psi, 450 F the code recommends alloy-steel studs with hex nuts on both ends. These nuts may be generally of carbon steel or at best a less-strong alloy than the studs. Extreme strength is not needed and the difference in metals in contact reduces chances of thread "freezing."

For high-pressure-flange studs the code recommends the "8-pitch Thread Series" which provides eight threads per inch for all bolts one inch or larger.

Standard flange-drilling templates come in multiples of four holes—four, eight, twelve, sixteen, etc. The flange holes in valves and fittings are set to straddle the centerline.

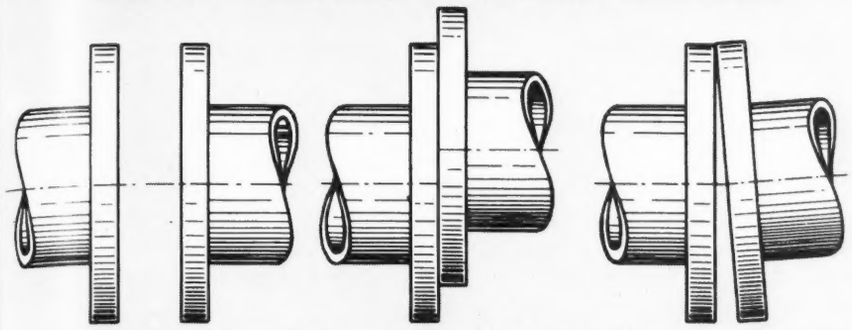
Of the flange faces shown above (top) many fitters prefer the raised face or the pipe-lap, with a ring gasket, because these joints (unlike the male-female and tongue-and-groove) do not have to be sprung apart to break a joint or remove a gasket. Grooved joints with thick soft gaskets are often used for low-temperature, high-pressure hydraulic joints. With either male-female or tongue-and-groove joints, the gasket should be thinner than the depression to avoid "mushrooming."

Widely used gasket materials range from soft rubber for cold water to narrow, solid iron rings for high-pressure steam joints. The table shows uses and limiting temperatures. Hand-cut gaskets for raised-face flanges should fit neatly inside the bolts and extend to, but not beyond, the edge of the pipe opening. If the joint has to be broken frequently, coat one side of the gasket with graphite to prevent sticking. When a joint has been newly made with soft packing take up on the bolts again after the line has been hot for some time.

Thin gaskets are less likely to blow than thick. If flanges fail to meet it may be risky to fill the gap with a thick, soft gasket. Better use a metal filler, gasketed both sides.

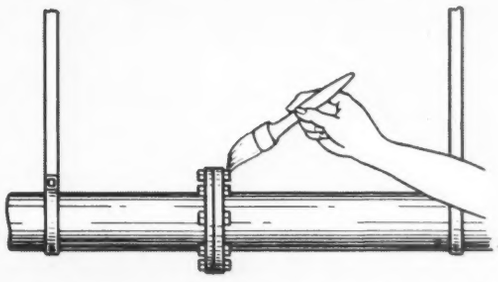
Raised faces of flanges are often serrated. These serrations, like corrugations in gaskets and the use of narrow gaskets, are means for increasing the gasket pressure per square inch by reducing contact area. Most leaky joints are the result of insufficient bolt tension and gasket pressure.

ALIGN FLANGES TO AVOID TROUBLE



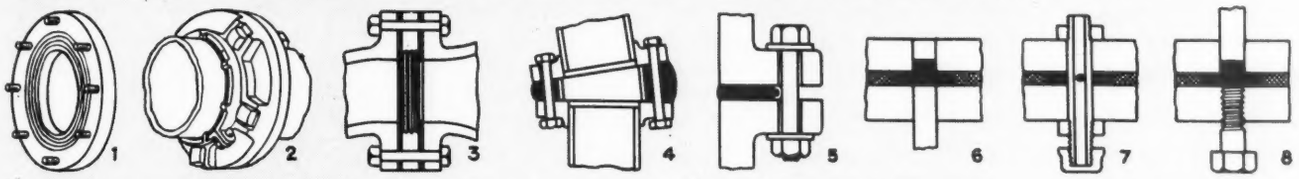
Careful lining up of flanges before bolting prevents excessive bolting stresses in valves, fittings and pipe flanges

USE THREAD LUBRICANT



Use of thread lubricant cuts friction, protects threads and makes joints easier to break for necessary repairs

PRACTICAL REPAIR METHODS KEEP FLANGED JOINTS TIGHT



Iron cement aids in making and repairing flanged joints. Corrugated-iron gasket coated both sides with iron cement will make tight joint (1) despite irregular flange faces. To plug leaky thread at flange, set band clamp with flat edge against flange (2) and tamp groove full of cement. If flanges can't be aligned, turn a metal "Dutchman" (3, 4) and seal it on both sides with iron cement or cement-plastered gaskets. To make a tight joint with rough-cast flanges (5) separate flanges by rope or soft spacers; then fill joint with cement. Localized leaks in flanges or gaskets may be plugged through adjacent bolt holes (6). Remove bolt, plug one side of hole and force cement through other side by hammering on a close-fitting rod. Or (7) inject cement with grease gun through pipe nipple with locknuts and a central side-outlet hole. If stud screws into flange, reverse stud (8), making a backstop for cement

According to Walker and Crocker (*Piping Handbook*) the initial gasket pressure should be at least 4000 psi for rubber, 12,000 psi for laminated asbestos in serrated joints and 30,000 to 60,000 psi for solid metal gaskets.

Ordinarily a tensile stress of about 7000 psi in the bolt would balance the actual steam pressure, yet the alloy-steel bolts of high-pressure joints are often stressed to 30,000 psi and sometimes to 60,000 psi to flow the gasket into the uneven surface of the flange and thereby insure tightness.

Tests have been made and tabulated showing how much wrench pull will create a given bolt tension in well-lubricated threads of a given pitch. The practical value of such tables is limited because of the great variation of pull with thread lubrication and also because it is rarely convenient to measure wrench pull, particularly where the wrench must be sledged.

From the practical angle, in the case of all medium- and low-pressure work, the fitter may as well continue to tighten by "feel" and experience. When this won't do, as with 1400-psi steam lines, the only reliable determination of bolt tension is by micrometer measurement of bolt elongation, using studs with machined micrometer pads and taking care that before-and-after measurements are taken cold and at the same temperature. The measured elongation must be referred to the grip distance between the nuts and *not* to the full length of the stud.

For steel of any composition a stress of 30,000 psi corresponds closely to a stretch of 1/1000 inch per inch, with other stresses and stretches in proportion up to the elastic limit. Thus, for a bolt with 3-in. grip, the total stretch should be 0.002 in. to create a unit tension of 20,000 psi in the bolt.

Like other piping leaks, those in flange joints grow rapidly. Fix them at the start. A frequent cause is poor alignment of piping. It should not be necessary to spring flanges into line.

All steamfitters agree that nut tightening should follow a definite sequence. Two are shown in the drawing —one "round and round," the other "criss-cross." Either should be satisfactory. An improvement on the second might be to tighten a single bolt on one side, then on the opposite—then move 90 degrees and repeat.

GASKET MATERIAL SELECTION
(from Piping Handbook, Walker & Crocker)

Gasket Material	Fluid	Usual Maximum Temp, F
Red rubber	Steam, air, water	250
Asbestos composition	Steam, water, oil	750
Fiber and paper	Oil	200
Synthetic rubber	Oil	200
Copper, corr or plain	Steam or water	600
Steel, corr or plain	Steam or water	1000
Stainless steel, 12-14% chromium, corrugated	Steam or water	1000
Hydrogen-annealed furniture iron	Steam or water	1000
Monel, corr or plain	Steam or water	1000
Ingot-iron, special gasket for ring-type joint	Steam, water, oil	1000

Welding—For Joints and All 'Round Maintenance

Each element of piping maintenance has two aspects: (1) how to select and install to reduce maintenance, (2) how to maintain. In the case of welded joints the second is practically eliminated. If the joint is rightly selected and made it should need no maintenance for the life of the plant. In general, maximum use of welding means minimum maintenance except where joints must be broken from time to time. Flange connections should be used at such points.

Most readers are familiar with the standard lines of welding fittings—ells, tees, crosses, flange necks, etc—also valves with welding necks. No attempt will be made here to show how to make pipe welds. That information is available in concise booklets issued by the manufacturers and in standard codes for the making and testing of welds and for the qualification of welders. The ASA Code for Pressure Piping covers welded joints from the specification angle. This brief story assumes that the maintenance man can make a good pipe weld, and will discuss only the maintenance angles of welding.

The elaborate sleeves, patches and reinforcements of the early days of welding reflected the user's lack of confidence in the process. Modern practice favors the plain butt weld, made by officially qualified welders following standard welding and testing procedures. Results have been so good that welding is preferred today for the highest pressures and temperatures. In such lines flanges are used only where joints must be breakable.

Joints

In low-pressure work welding has the disadvantage that cast-iron valves cannot be welded in, so one must either use the more expensive steel valves or install the cast-iron valves with flanged joints.

For pipe wall up to ¾-in. thick the sides of the standard butt joint are beveled 37½ deg, with a 1/16-in. land. For thicker pipe the bevel is U-shape to avoid the need for excessive welding. Chill rings insure full penetration of the weld without the formation of dangerous "icicles" in the pipe. Except for high-velocity steam, the extra cost of a *flush* chill (see sketch) is rarely warranted.

Flanges can be brought into a welded system in the three ways pictured below. The lap-joint stub end, welded to the pipe and backed by a slip-on flange, gives the highest type of lap joint. A quick field connection can be improvised by joining a slip-on flange to the pipe end by two fillet welds as shown. Welding may be used also to seal the thread where a flange is screwed onto a pipe.

In high-pressure work it is best to build up welds in ⅛-in. layers, cleaning and inspecting after each layer. This catches defects before they are buried. Moreover, the heat of each layer improves the grain structure of the underlying layer.

It is considered unsafe to weld "carbon-moly" steel without preheating, so induction and resistance electric heaters have been designed to keep the pipe at 300-600 F throughout the welding. Similar heaters are used to stress relieve high-strength welds at 1200 F.

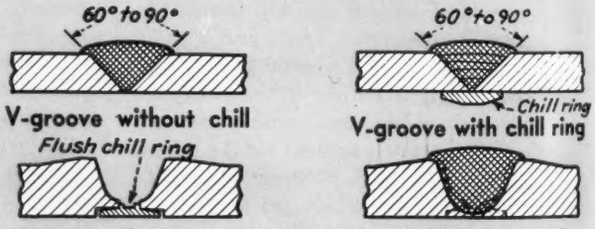
THREE WAYS TO ATTACH FLANGES

Weld-neck flange

Welding nipple with pipe lap

Slip-on flange field-welded to pipe end

THREE TYPES OF BUTT WELDS



V-groove without chill

V-groove with chill ring

U-joint with flush chill ring and reinforced end for high-velocity high-pressure steam (before and after)

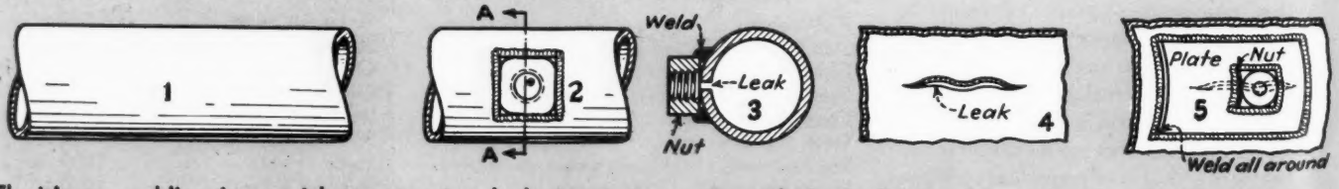
SPECIAL-PURPOSE SLEEVES

Screwed coupling, back-welded for extra tightness

Butt weld plus welded sleeve, used only for unusual stress

Cup joint for field joints, where lining-up is inconvenient

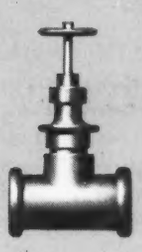
HOW TO WELD LEAKS UNDER PRESSURE



Electric-arc welding is a quick way to stop leaks in pipe under pressure. To close pinhole leak (1), weld an ordinary square-headed machine nut around leak (2, 3). This permits water, etc., to escape through the hole in the nut during welding, making it possible to complete the weld. To stop the leak, screw a bolt into the nut with sealing compound

A cracked or split pipe (4) can be closed in the same way. This kind of leak is usually too large to be covered by a nut, so a piece of plate stock is applied as a patch. Drill a small hole in the plate and shape the plate to the pipe. Next weld a nut over the hole and weld the plate to the pipe (5). Then screw in a bolt or plug, using sealing compound

VALVES



Give the Valve a Chance —Select It for the Job

VALVE CARE really starts before actual purchase; long life and low maintenance depend on fitting the valve to the job. Before specifying any valve, consider flow to be handled, temperature and pressure, kind of fluid, nature of service, and physical conditions at point of installation. Check these points when a valve in service gives trouble; failure to suit the valve to conditions lies at the root of many troubles and causes unnecessary damage.

Valves commonly match pipe size without regard for rate of flow under working conditions. It is not unusual to find a large valve passing full flow with the disk barely raised from the seat. Selecting valve size to pass maximum flow when wide open, and using reducers to connect valve to pipe, permits keeping the disk out of the flow as far as possible, reducing seat and disk erosion to a minimum.

Bodies

Temperature and pressure requirements directly affect choice of valve materials. Bronze bodies, in sizes up to 3 in., serve for steam pressures as high as 350 psi at 550 F. Cast iron is suitable for 250-psi 450-F steam. Higher temperatures and pressures require steel bodies. Similar consideration must be given to all parts exposed to high temperature; springs in internal-spring safety valves, for example. Choice and importance of correct valve trim is discussed in detail later.

The fluid to be handled affects valve selection in two ways: corrosive or erosive properties determine materials, and physical properties influence choice of valve construction. No arbitrary rule can be applied to all fluids. For steam and condensate, cost and strength considerations are usually more important than corrosion resistance. Raw water, salt water, and most common industrial solutions are electrolytes and may cause corrosion where dissimilar metals are present. The cure for persistent corrosion troubles often lies in switching to an all-iron, all-bronze or all-steel system. Highly corrosive fluids require special materials; consult the manufacturer.

Fluids

Use one-piece-wedge gate valves for gummy liquids or when the valve must be installed with stem pointing downward. Double-disk or split-wedge gates suit liquids carrying suspended matter because their flexibility permits one disk to seat even though grit prevents contact on the other side. The sleeve or seatless angle valve has no exposed seating surfaces, making it suitable for abrasive fluids.

Deciding between valves suited for free flow and valves suited for flow control proves a stumbling block in many cases. A flow-control valve offers some restriction even when wide open and the valve giving greatest control introduces most resistance (see chart). Gate valves and plug cocks, offering least flow resistance, fit cut-off and free-flow applications such as boiler water columns, blowdown lines, header-flushing drains and pump and compressor cutoffs. Ordinary globe, angle or Y valves offer only slightly greater resistance and prove suitable for cutoff and free-flow service if a slight pressure drop is permissible.

To insure convenient operation and inspection, make allowance for physical conditions at point of installation. Rising-stem valves give visual indication of disk position but headroom must be available for the stem rise. If a bend occurs near a globe valve, select an angle valve in preference to a straight valve and elbow. This reduces flow resistance and lowers piping cost.

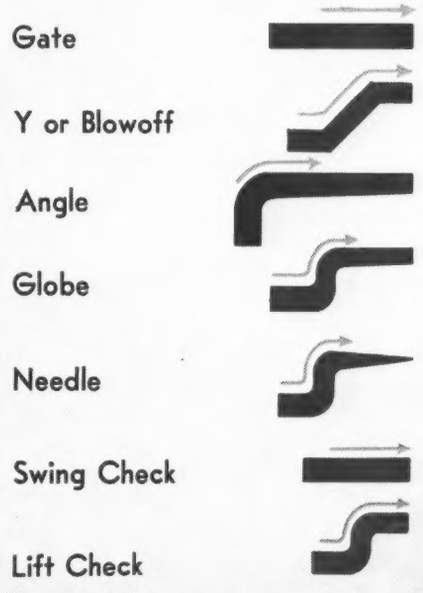
Thought given to choice of valve details, such as bonnet construction, trim, and method of stem operation will pay dividends in long life and ease of maintenance. Bonnets and bodies connect by threaded, union, flanged, welded, or brazed joints. The union-ring construction eliminates the danger of removing the bonnet when turning the handwheel, stiffens the body against internal pressure, eliminates to a large extent any danger of distortion and provides a part not directly subject to internal pressure to take the wrench action. With this joint the bonnet serves as a guide for the stem during seat grinding.

Disks and seats, part of the "trim", play an important part in valve operation. Seats may be an integral part of the body or may be of different material, screwed, welded, or rolled to a tight fit. Seat metal must be hard and tough and have a coefficient of friction corresponding closely to that of the body, to prevent loosening and consequent leakage. There must be enough difference in hardness and sliding-friction qualities between seats and disks to prevent seizing, which cannot be avoided simply by providing smooth surface finish. Seat and disk materials must not "grow" at service temperatures and to retain the smooth surface necessary for tightness they must resist oxidation, erosion and corrosion under service conditions.

For low-pressure low-temperature service, not characterized by excessive corrosion, iron and brass trim is commonly used. Stainless iron, an alloy of iron and chromium, is recommended

VALVE FLOW CHART

The closer a valve regulates flow the more resistance it offers. Chart shows direction changes and restriction of flow



for handling steam, oils containing sulphur, and other corrosive fluids. Many ferrous and non-ferrous alloys are available for trim in the moderate-pressure moderate-temperature range, including stainless steel, monel, and stainless iron. For the most severe conditions of temperature and pressure, 13% chrome steel, nitrided steel and cobalt-chromium-tungsten alloys meet most needs. Nitriding involves heat treatment in the presence of ammonia gas. Cobalt-chromium-tungsten alloys (Stellite) are deposited by welding; they retain their hardness under red-heat conditions.

Globe-valve disks may be either metal or composition. For the latter, select rubber in various grades of hardness for cold water, hot water and air; molded asbestos and rubber for steam service, oil-resistant synthetic rubber for petroleum and its fractions. The safe upper temperature limit for composition disks is 400 F. Disks designed for 150-psi steam can be used for other fluids at 300 psi if temperature does not exceed 150 F.

The composition disk, with its small bearing surface, although likely to be cut by foreign matter, will stand considerable embedding of dirt before leaking. This disk has a shorter life than a metallic plug; in an emergency, it can be reversed or, if not too badly damaged, machined to a new face. Composition disks give good service under open-and-shut conditions when operation is not too frequent.

On installations that involve frequent operation, each closing and opening subjects seat and disk, for a short time, to an erosive effect comparable to that which occurs in a throttling valve. For such service, consider semi-plug or plug-disk valves designed for throttling operation. Use plug-disk valves for throttling work; the wide seating surface offers considerable resistance to wear and injury from foreign matter. On frequently operated or throttling valves, seats and disks of harder materials than required by temperature, more able to resist erosion, will pay dividends in longer service life.

Gate Disks

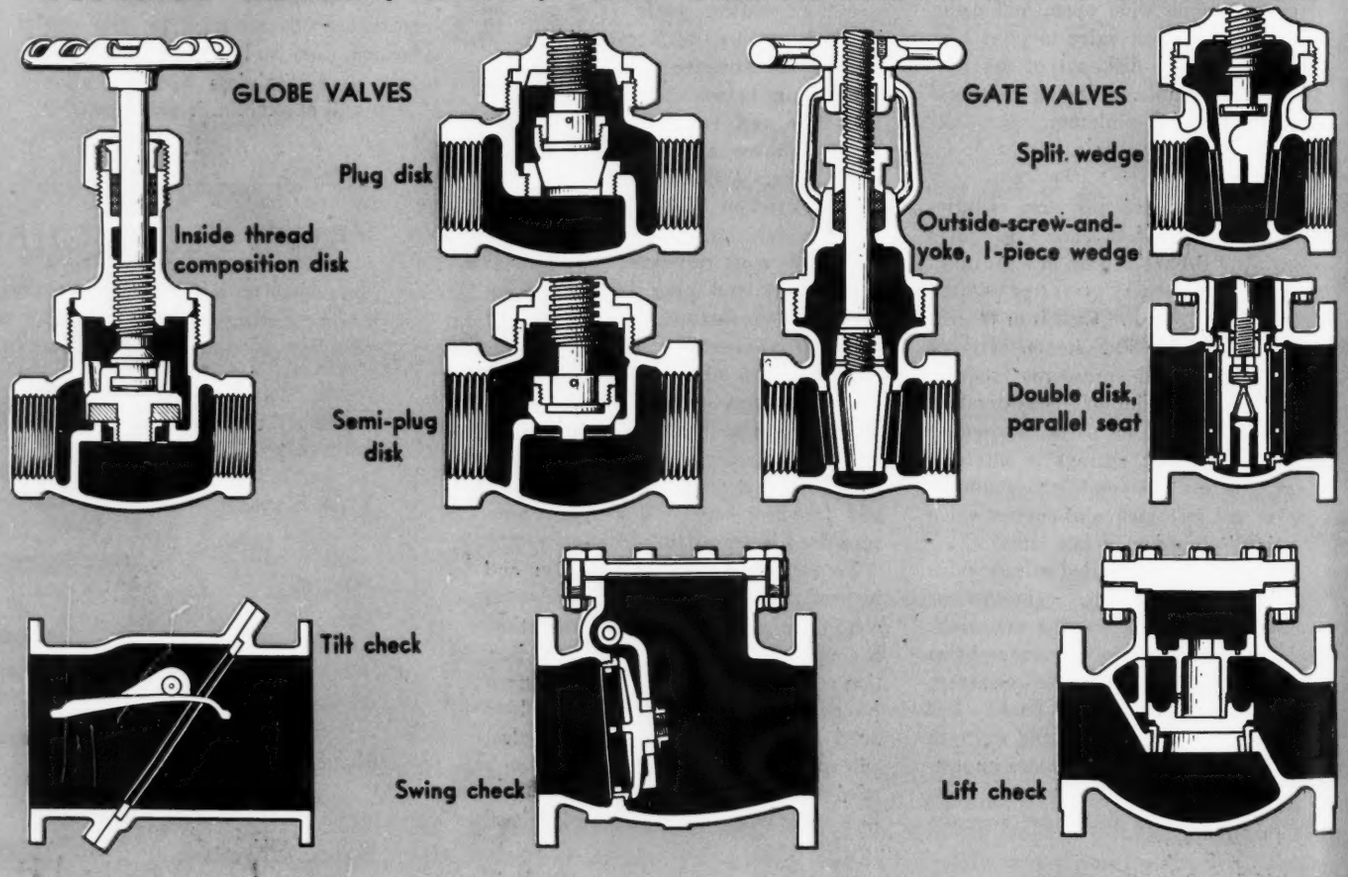
Disks for gate valves are shaped as solid wedges, split wedges, or double disks with parallel seats. The "solid" wedge is one-piece and sometimes hollow. The wedge metal itself forms the disk seating area or, in some iron valves, a ring of different metal, pressed into a groove machined in the wedge, does the job. Because the disk in a parallel-seat gate slides against the seat during final closing and initial opening, metals used must not seize or drag. The solid wedge, being held away by guides, comes into contact with its seat only at the extreme closing point, with no opportunity to seize.

Stems

Stem choice depends on installation conditions and the fluid being handled. Rising stems require headroom and may suffer bending or other damage. Non-rising stems require no additional room but absence of any visual indication of disk position may result in excessive operating strains in the wrong direction, particularly on valves with excessive friction caused by lack of lubrication or dry packing. Fluid contact with internal threads makes such stems unsuited for abrasive or encrusting fluids. External threads are exposed to atmospheric conditions but are easy to lubricate.

Certain special considerations apply to check and regulating valves. Action of the fluid as it flows through the body operates a check-valve disk, lifting or swinging it away from the seat. Some

TYPICAL GLOBE-, GATE-, AND CHECK-VALVE CONSTRUCTIONS



lift-check disks act as a piston in a cylinder formed by a body neck above the seat. The piston-like action cushions the disk and prevents it slamming against the cover, making this type particularly suited to pulsating flow. In other designs a spring above the disk performs the same function and returns the disk to its seat quickly. Temperatures above 300 F require springs of special material.

To prevent shock, a check valve must close before reversal of flow gains momentum. For vertical lines of considerable height select quick-acting lift or tilt checks; spring-loaded checks also insure rapid closure.

When selecting a regulating valve consider the method of operation as well as the type of inner valve. These units are generally operated by means of a diaphragm, piston or bellows mechanism. Diaphragms and bellows, usually single-acting devices, require a loading unit to oppose their action and move the disk in the opposite direction, to its original position.

Spring, weight, and static-balance loading methods each offer advantages; choice depends on the nature of the service. Constant only at a given compression, springs exert more power at greater compressions. This means that a direct-connected spring-loaded regulator performs best when flow conditions are steady. Varying demands cause disk movement, change spring loading, and give varying reduced pressure. With integral auxiliary-pilot control or external pilot control with separate operating medium, spring loading operates successfully because maximum spring movement is slight and operating pressure is more positive. Powerful hydraulic-piston operators are particularly suited for large valves. In weight-loaded valves, constant effective loading regardless of disk movement gives exact reduced pressure.

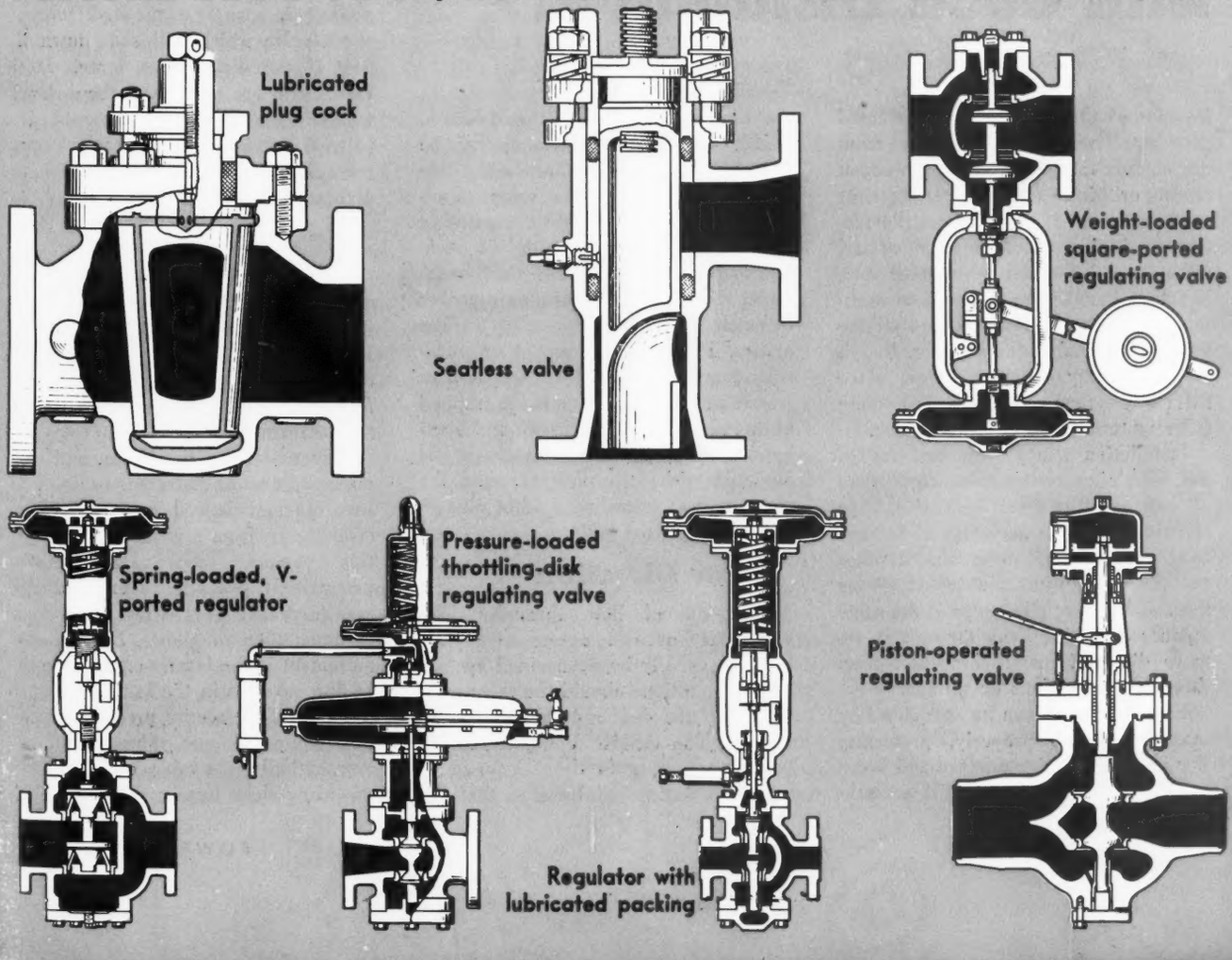
Diaphragms

Disk movement affects the loading method used for each pressure-regulating problem. Full diaphragm power is applied to the stem only as long as the diaphragm remains in full contact with the diaphragm head. Whenever valve assembly or improper adjustment causes the diaphragm to bow away from the head the stem receives less force, at a time, perhaps, when spring compression is greatest.

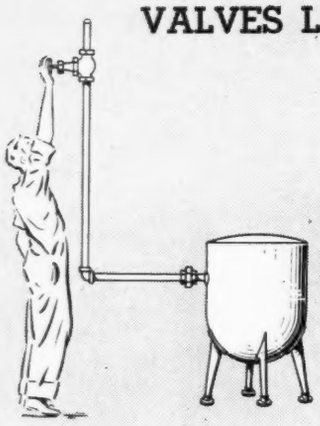
Frequently used inner valves include poppet-port, V-port, ratio-plug and throttling-plug types. These are available with either single or double ports. Use a poppet port when quick opening at maximum capacity is needed. The V-port develops close throttling during the first 25–30% of travel and continues this control until maximum capacity is reached. The ratio plug throttles closely during the first half of its travel but port area opens at a much faster rate after the plug passes mid-position. The throttle plug produces close action during the first 10% of travel; additional lift increases port area at a greater rate per unit of lift, giving essentially a straight-line relation between travel and flow. A single-ported valve gives tighter closure than a balanced double-port, which cannot be depended on when safety demands a positive shutoff.

Too much stress cannot be placed on the importance of determining the correct regulating-valve size. Naturally the valve should not be too small, but it is equally important that it not be too large. An oversize valve gives uneven regulation and the restricted opening subjects seats to wiredrawing. Manufacturers furnish curves showing valve size needed for each condition; consult these before making a purchase.

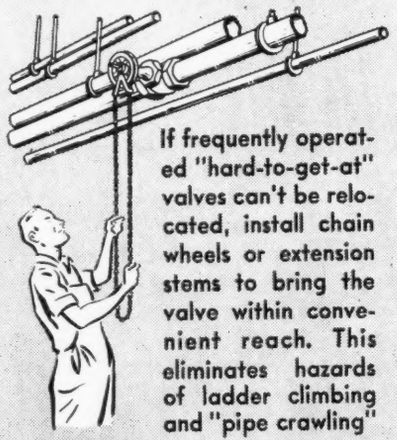
TYPICAL PLUG-COCK, SEATLESS AND REGULATING VALVES



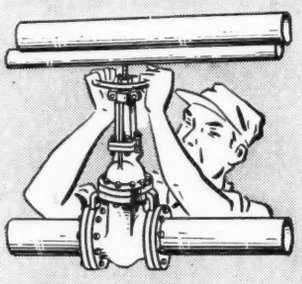
VALVES LAST LONGER IF PROPERLY INSTALLED



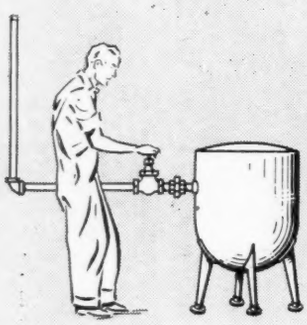
Locate valves where they can be reached conveniently, to insure proper operation. Valves won't be opened fully, closed tightly, or regulated properly if the operator can't do the job with convenience and safety



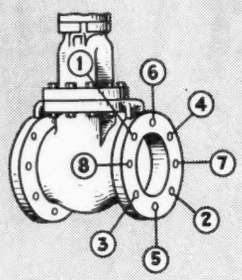
If frequently operated "hard-to-get-at" valves can't be relocated, install chain wheels or extension stems to bring the valve within convenient reach. This eliminates hazards of ladder climbing and "pipe crawling"



Be sure to allow ample clearance for rising-stem valves, including room to remove stem and bonnet for inspection. If lack of clearance prevents full opening, excessive pressure drop, disk vibration, and seat wear will result



Tighten bolts according to cross-over method shown. This insures true bearing over the flange faces and reduces stress on flanges and other valve parts



Long Valve Life Begins with Good Installation

DAMAGE IN STORAGE OR HANDLING, and poor installation, handicap a valve from the start. Complete wrapping, wooden crating or thin metal caps over the ends protect valves as shipped from the factory. Keep this protection in place and store the valve under cover until it is installed. Penetration of sand into working parts often follows storage on the ground, exposed to the weather. Rough handling easily damages valves; place them where they cannot fall and where other material cannot fall on them.

Installation starts with removal of the valve's protective covering; clean all grit and dirt from the inside. Pipe cleaning is just as necessary if damage to seats and disks is to be avoided. Blow out the valve with compressed air or flush with water; clean pipe in the same manner or pull a swab through to remove dirt and metal chips left from threading, operations or storage.

Future troubles can be minimized by mounting valves properly, protecting them against outside damage and locating them at the most suitable point in the line. Except for split-wedge and double-disk gates, most valves can be mounted at any angle, although it is always better, from the valve standpoint, to mount it with stem pointing upward. Any position with the stem pointing downward brings the bonnet under the line of flow, forming a pocket to catch pipe scale and other foreign matter. This soon cuts and destroys inside stem threads. On lines exposed to freezing temperatures, moisture trapped at this point may cause frozen and burst bonnets. Even when the valve is mounted with stem upright, take the precaution of installing a drain plug in the bottom of the body.

Flow Direction

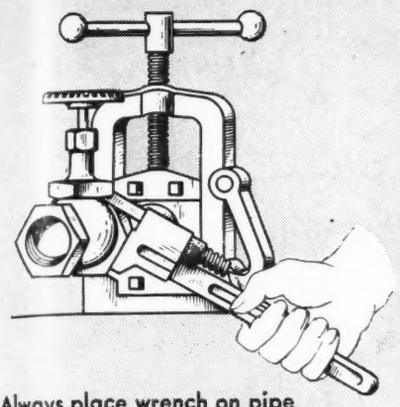
Direction of flow through globe valves depends on nature of service and can usually be determined by asking the question "should the valve open or shut if the disk and stem part company?" The ASME Boiler Code requires pressure *under* the disk for globe valves in boiler-feed lines so that the loose disk will not act as a check and stop water flow. If the valve controls equipment which might overspeed, applying pressure *over* the disk forms a check valve which will shut down the unit if the disk comes loose. Drain valves with pressure under the disk will vibrate open if not tightly closed. If a valve is persistently left cracked open, reversing it to put pressure over the disk will insure tighter closing.

General Rule

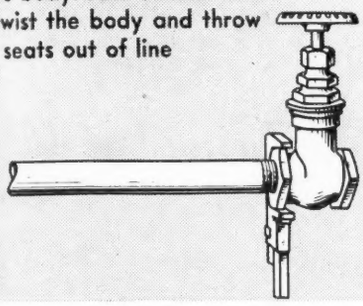
To summarize: unless the service clearly requires pressure *under* the disk, install the valve to put pressure on top. Pressure over the disk aids in keeping the valve closed, tending to compensate for any stem contraction caused by temperature changes.

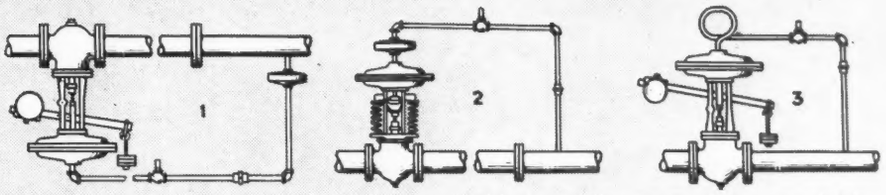
Valves of large size, 12-in. and over, present generous disk areas to line pressure. In unbalanced service, such as discharging from high to low pressure, this pressure makes valve operation increasingly difficult as exposed disk area increases. This is less pronounced in gates than in globes, because disk movement in the former crosses the line of flow whereas in the latter it opposes the flow. To minimize pressure difficulties, equip all gate valves 12-in. and over, and all globe valves over 6 in., with throttling-globe bypass valves.

GOOD REGULATOR HOOKUPS PAY

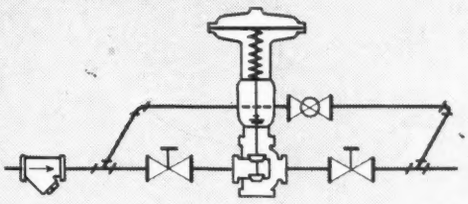


Always place wrench on pipe end of valve. This gives more direct leverage on the joint and avoids straining the valve body. Such strains tend to twist the body and throw the seats out of line

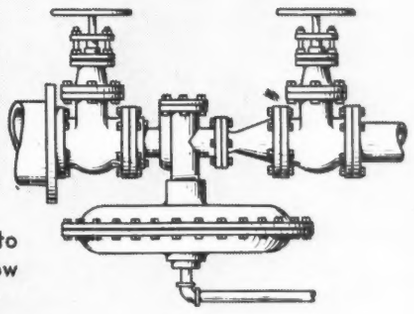




Connect pilot line at least 10 ft downstream from regulator; tap into a straight pipe run (1), never into an elbow or bend. If a commercial sealing chamber (2) is not available, install a pipe loop (3) to keep steam from reaching diaphragm



Strainer protects valve; bypass permits removal for inspection and maintenance



Match valve size to flow rather than to pipe size. Venturi reducers give smooth flow conditions; reducing flanges save space

In pipe lines handling sludge or other suspended matter keep valves out of vertical lines whenever possible; stoppage of flow allows suspended matter to settle and choke a closed valve. This is especially troublesome when it interferes with check-valve operation.

Never install a valve without thought as to access. To be sure valves are opened and closed correctly, make it convenient and safe to do so. Don't expect a man standing on a ladder, reaching for an overhead valve, to exert any great amount of force. Install the valve horizontally and fit it with a chain operator which can be reached from floor level. Overhead valves on large lines, requiring two-man operation, should be vertical, to permit operators to stand on pipe. If possible install a working platform, extend the valve stem through the floor above, provide an impactor handwheel or a power operator.

Watch Height

Beware of valves just within finger-tip reach of a normal man; rather than hunt for something to stand on, he'll stretch just enough to reach the handwheel. The valve cannot be closed tight and leakage will develop. Always allow sufficient clearance for rising stems and for removing bonnet and stem. It's much easier to leave the valve in the line and only remove internal parts for inspection and cleaning. Providing easy access to all valves represents the first step to correct operation, regular inspection and careful maintenance.

Good check valve service depends to a large extent on meeting special needs. Correct position is most important; install swing and tilt checks with the pin horizontal and so that gravity will close the disk; place lift checks so that the lift is vertical.

Protect Diaphragm

Diaphragm-operated valves present problems connected with the diaphragm as well as with the inner valve. Inverted installation on oil or chemical lines exposes the diaphragm to leakage through the stem packing. Heat from adjacent steam lines may cause early deterioration of the rubber. On steam-operated valves, protect the diaphragm against steam contact by installing a water leg or accumulator and filling it with water before admitting steam.

When using the regulated pressure as the actuating medium, connect the pilot line, controlled by a lock-shield globe valve, on the downstream side of the valve. Don't make the connection in an elbow or pipe bend because erratic pressures occur at these points. Select as a connection point a straight section of pipe at least 10 ft from the valve. The globe valve permits throttling the pilot supply to smooth out pressure pulsations and the lock shield protects against tampering.

Regulating-valve bodies, marked as to flow direction, must be inserted in the line to conform with the marking. A correctly chosen valve will not necessarily match the pipe size. For the connections, reducing flanges or bushings save space but bell or venturi reducers give better flow conditions. Install a strainer ahead of the valve to remove foreign matter and protect the seats. Impingement noises can be minimized by installing the valve in a straight pipe run. Don't install an elbow or bend immediately downstream of the valve. To facilitate the regular inspection regulating valves deserve, connect a throttling globe valve as a bypass.

Check every valve installation for ways to simplify maintenance. When applying pipe insulation, end the permanent covering at bonnet bolts. Use a removable section to cover the bonnet, otherwise internal inspection may be neglected because of hesitation in breaking a perfect-looking insulated joint. After the system has been heated to operating temperature, tighten all body and bonnet bolts and adjust stem packing.

Planned Maintenance Keeps Valves in Service

NEGLECTING A VALVE until it must be replaced or fitted with new parts wastes strategic materials; frequent and regular inspections uncover leaks and reveal other conditions, such as corrosion, incrustation, and wiredrawing, that mean future trouble unless corrected. Caught early, these defects can be repaired without major difficulty or expense; allowed to go unattended, they require hard-to-get parts and materials and may cause production shutdowns.

A good maintenance program includes correct operation, regular and systematic inspection, proper lubrication of all rotating or sliding parts, replacement of stem packing when leakage or excessive friction develops, and refacing leaking seats and disks. Valve parts such as stem threads, thrust washers, and disk-spacing wedges or cams must be kept free of corrosion, incrustation, or foreign materials and must be adequately lubricated as recommended by the manufacturer. Plug cocks, with their large metal surfaces, require frequent lubrication to prevent galling and seizing of the sliding parts.

Packing

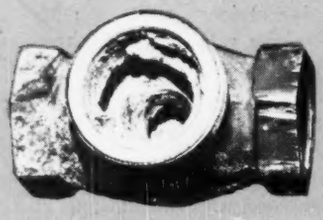
Proper maintenance of packing and correct adjustment of packing nuts are essential to satisfactory stem life and good valve performance. New packing, impregnated with graphite, lubricates the stem; after this lubricant disappears, friction between stem and packing increases. If the packing nut must be tightened to a point where it is difficult to turn the stem, the packing has become dry and hard, or is unsuitable for the service. In either case it should be discarded; it imposes an additional burden that will rapidly shorten stem-thread life.

Excessive packing compression causes uncertainty as to whether or not the valve is fully seated. As a result, operators frequently seat valves tighter than they need be. This excessive closing effort, often applied with a wrench, injures the stem threads.

Stem packing that has been subjected to high-temperature steam and then allowed to cool, often leaks a small amount when the line goes into operation again. Expansion and contraction of bonnet, stem, packing, gland and packing nut cause this condition. It does not necessarily call for adjustment of packing nut or gland; as soon as the valve becomes hot it will, in most cases, stop leaking.

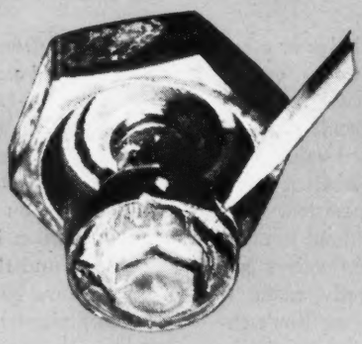
Packing maintenance is particularly important on automatically operated

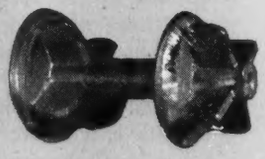
INSPECTION AND MAINTENANCE COULD HAVE SAVED THESE VALVES



Scale prevents proper seating; keep surfaces clean

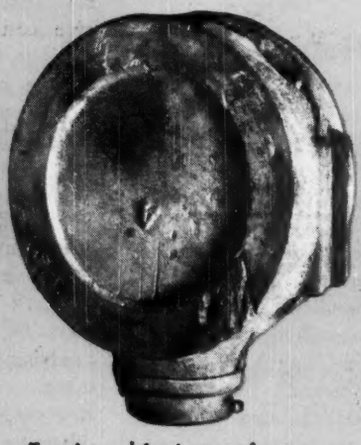
Leaving this valve cracked open caused wiredrawing of seat, disk



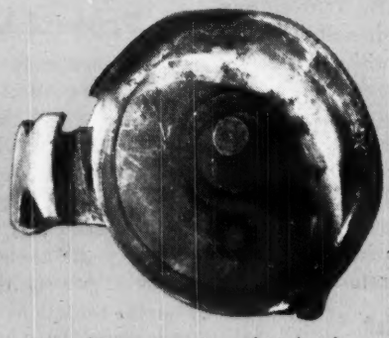


Use of valve too large for flow caused this erosion

If corrosion can't be avoided, remove rust regularly

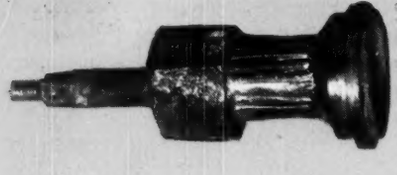


Foreign objects, erosion, or rough handling scar wedges

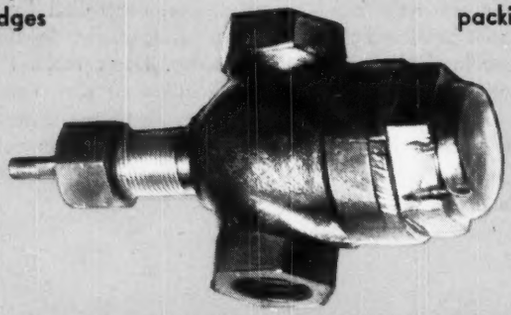


Lacking attention, this check hammered itself to pieces

Taking up too far on old packing split this gland nut



Misuse of pipe wrench crushed bonnet and froze stem



Scars prove hammer and chisel can't replace wrench

valves; excessive friction causes erratic movement. When lubricators are provided, keep stem and packing adequately lubricated.

Use stem packing that fits; preformed rings enter easily and draw up evenly. When winding coil packing spirally around the valve stem, force it to the outer edge of the stuffing box instead of wrapping it tightly to the stem. After adding the maximum number of rings, draw up the gland evenly, with a wrench, until the packing is forced into snug position. Then slack off on the gland and make the nut finger tight. A good valve stem, sufficient packing of the right kind, and a finger-tight gland will hold all moderate pressures. Higher pressures require tighter gland to prevent applied pressure from getting in under the packing.

Many valves contain a back seat closing off the packing gland against pressure, when the valve is open. This arrangement permits repacking the stem with the valve under pressure. Be certain a valve has this feature before attempting to repack under pressure.

Maintenance and inspection involve frequent dismantling and reassembling of valves. Knowing the best way to do these operations simplifies the job and avoids damage to valves from improper handling. Before starting to remove a bonnet, open the valve so that no bending stress is placed on the stem during removal. Likewise, put the stem in the "open" position before replacing a bonnet. U-clamp gate-valve bodies have been split by tightening the bonnet joint with the wedge in extreme closed position; union-bonnet gate-valve seats have been sprung apart by wedging action in the same manner.

Bolt Tension

On valves designed for high-temperature high-pressure service, bonnet bolts are usually tightened until a known tension is imposed on the bolt. Before loosening nuts, clean bolt ends and measure bolt length with a micrometer. Keep a record of individual bolt lengths and elongate them the same amount when reassembling the valve, making sure valve and bolt temperatures are the same as before. Always draw up body bolts evenly until the bonnet is true and square with the body.

Most actual maintenance and repair operations are concerned with keeping seats and disks in leakproof condition. The specific methods used depend on valve construction, condition of seats and disks, and equipment available. Modern methods of building up metallic surfaces (hard soldering, brazing or welding) now offer means of salvaging valves with badly eroded seats and disks. Such building up makes repair possible without removal of parent metal, greatly extending valve life.

Build up bronze seats with hard solder or bronze rod; alloy-steel seats for temperatures below 750 F can be repaired by brazing, which, although not as resistant as the original metal, will give good service. Building up alloy trim with supposedly identical metals can easily lead to trouble unless complete information is available as to composition and hardness of parent metal. Before building up disks on automatic valves for service on high pressures and temperatures, consult the manufacturer, because any considerable change in seat or disk contour may cause serious operating difficulties.

If facilities for building up special trim metal are not available, the valve can be returned to the factory, although this practice may interfere with war production. When it is absolutely necessary to buy new parts, buy seats and disks in pairs so that only a minimum amount of grinding is needed. Salvage all good parts of damaged valves for use as spare parts to rebuild other valves when they become damaged.

Seats and disks can be ground or refaced in many ways. The procedure for grinding seats and disks in union-bonnet globe valves is, perhaps, the simplest. It is only necessary to pin stem and disk together and use the bonnet as a guide for lapping the disk against the seat. Screwed bonnets cannot be used as guides for grinding; this job requires a grinding kit or drillpress. If a drillpress is available, remove stem from bonnet and insert in drill chuck. Clamp the valve body in the drillpress vise; level on the top edge of the body-bonnet joint which parallels the seat surfaces. Pin disk and stem, apply compound, and grind with drillpress at low speed and light spindle pressure.

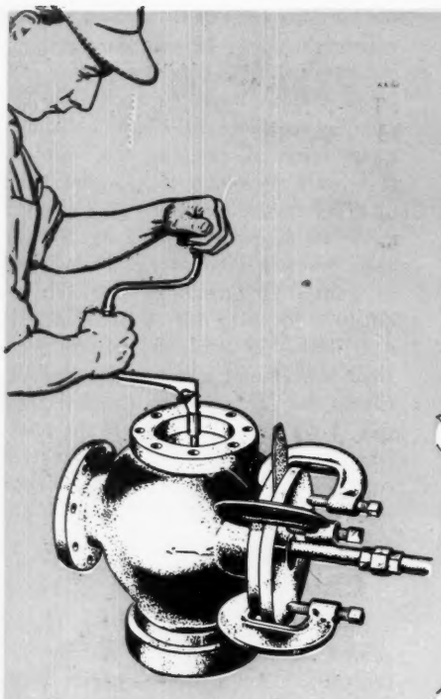
Check Valves

Check-valve disks can be lapped against the seats; the disk usually contains a slot for a screwdriver to apply the turning movement.

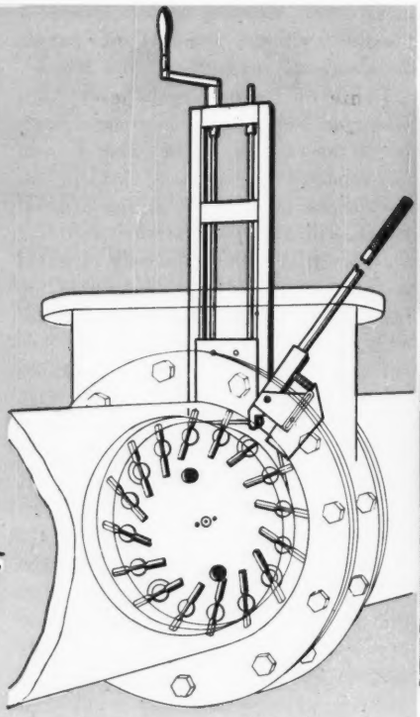
When lapping stainless iron disks and

HOW TO REGRIND GLOBE-VALVE SEATS

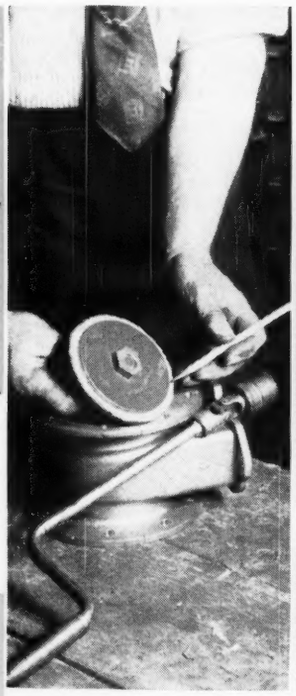
Rotate disk to line up locknut slot with hole in stem. Insert pin or nail to lock disk and stem together
Apply grinding compound to seat and disk with finger. Use fine-grain compound and keep coating thin
Set bonnet assembly in body and turn handwheel until disk touches seat. Continue turning until bonnet rises 1/32"
Screw union handtight, then back off one turn. Oscillate handwheel and bonnet; occasionally turn to a new spot
After grinding surfaces to a good seat, wipe seat and disk with a cloth wet with gasoline or other solvent
Be sure to clean away all grinding compound from seat and disk. Remove pin from hole and reassemble valve



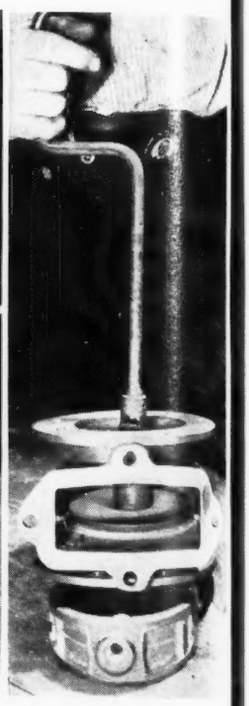
Convenient steam connection permits heating double-ported regulator before grinding seats



Reseating machines, like that shown, make it possible to resurface seats without removing valve from line



Simple hand tools for grinding gate-valve seats: metal plate with emery cloth forms disk



Insert grinding disk. Turn or oscillate hand brace; universal joint guards against uneven cut

seats against each other, mix white-lead and oil with the grinding compound to provide lubrication, otherwise the metal will drag and ruin the surfaces. Use of grinding compound with small grain size reduces tendency to gall. Grind with light strokes, lifting the disk frequently to a new position and cleaning the surfaces often. Stellited seats and disks can be ground in the same manner as that recommended for stainless iron, except that in some cases it may be necessary to use silicon-carbide grit.

Balanced-pressure double-seat regulating valves require particular care in grinding. Both seats must be established at the same time. Watch the disks to see which seat touches first; put compound on this disk with just a trace on the other. Grind until both seats are established uniformly. To produce a true seat under operating conditions, provide a steam connection to heat body and stem to operating temperature, before grinding.

Machining

On globe valves which are badly worn, or where eroded areas have been built up, machining eliminates excessive lapping. Seats can be machined in a lathe, or ground with an emery-cloth-covered metal disk mounted in a drill press. A similar grinding disk, mounted on a motor-driven flexible shaft, can also be used on small valves.

Repeated machining or grinding may reduce seat thickness dangerously. On integral-seat globe valves too small to insert soldering or brazing equipment, the seat opening can be reamed and threaded to take a renewable seat ring which can be made up from material available in the plant shop. While it is desirable to replace the seat with the same metal, a different one can be used in an emergency. It is not advisable to use stainless iron of the same hardness for both seat and disk unless the valve is to handle oil.

Seat Rings

Repeated refacing of shoulder-design seat rings reduces shoulder thickness to a point where metal contact pressure against the under side causes concaving of the outer or seating surface. The remedy lies in replacing the ring or increasing its thickness by welded overlays. Leakage past seat-ring threads must be repaired immediately; it can be done by welding and rethreading or by reaming and threading to take an oversize ring. If the damage is too great for these remedies, weld the ring solidly in the valve body.

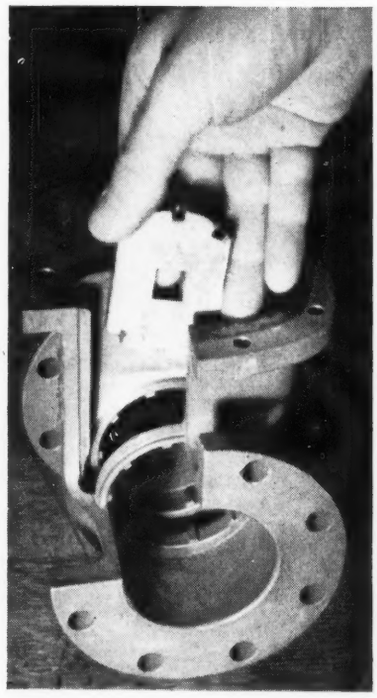
Good service from composition globe-valve disks depends on care. When one side of such a disk is eroded, either machine it to a new face or reverse it and use the opposite side. Disk stocks can be stretched by using substitutes such as leather, scrap rubber belting or lead machined smooth. Although not ideal, these materials will give satisfactory service until new disks arrive.

Refacing

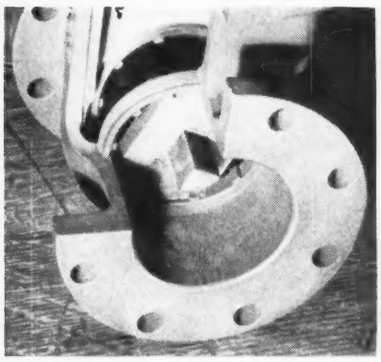
Refacing of gate-valve seats and disks usually requires machining in a lathe or grinding in a drillpress although disks with surfaces not too badly worn can be refaced with a sanding wheel or by hand grinding and seats can be ground with a hand brace. Lathe machining offers no major difficulties for parallel-seat gate bodies but wedge-gate bodies require cumbersome holders. The drillpress grinding method, described in some detail in the next article, is a convenient method.

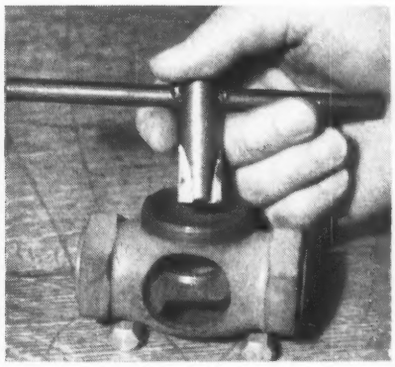
Parallel-seat disks may be chucked readily for lathe refacing; a taper block to fit the faceplate helps with wedge disks. The drillpress grinding method (see next article) can be used on wedges as well as seats. Special holding jigs, milled out to hold the wedge snug and level and keep it from turning, offer maximum convenience but a jig is required for each valve size. One flat tapered plate, with clamps,

STURDY WRENCHES MAKE SEAT REMOVAL EASY



Use great care in removing seat rings to prevent unnecessary damage. Make-shift arrangements invariably lead to broken seat lugs or burred grooves. If conventional wrenches are not available, homemade devices will work satisfactorily if accurately constructed so that they bear uniformly on all seat lugs or grooves and if substantial enough to transmit the turning effort required for removing or replacing the seat. Manufacturers screw seats into place with machine power and any oxidation of the metal makes them extremely difficult to remove unless sturdy wrenches are used. If a seat ring appears to be abnormally tight, close inspection will show if it has been silver soldered or tack welded in place





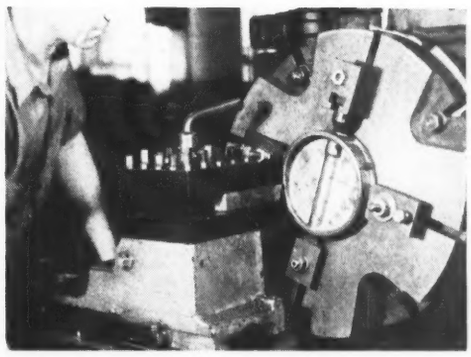
will serve for many sizes and can be used on either drillpress or lathe (see right). Wedge disks can also be refaced by holding the surface against a motor-driven sanding or grinding disk. Keep the wedge centered on the disk and hold with uniform pressure or uneven grinding will ruin the taper. Hand grinding on an emery-cloth-covered flat surface proves satisfactory where only light scratches or machine marks need to be removed.

Reseating Kits

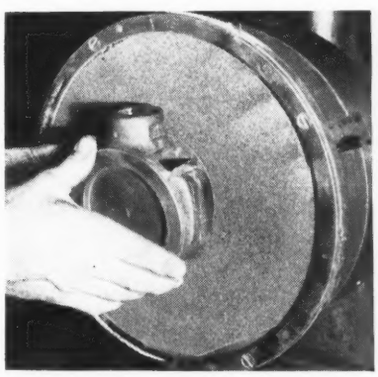
Most of the methods described so far require that the valve be removed from the line. Valve reseating kits are available for refacing seat rings without removing the body from the line. This eliminates need for breaking pipe joints, reduces possibilities of leaks and saves time and labor.

Valves subjected to corrosive conditions soon become covered with "barnacles" which build up around seat and disk rings. If allowed to increase to any great extent, the barnacles soon creep over the seat edges and prevent the valve from closing tight. Cleaning the valve with a sandblast and applying a good paint or metal-spray coating on the areas around the seats greatly retards this growth. Timely repairs make valves last longer and save metal.

Building up with weld metal offers a practical way to save badly worn disks. Machine and grind



Remove excess weld metal in lathe with taper face plate. This is first step on disks too rough for grinding but not needing welding



Power-driven grinder produces smooth finish; keep disk near center of wheel to avoid excessive grinding on one side

Hand grinding on flat emery-cloth-covered surface removes light scratches. Move the disk in small circles

How One Plant Repairs Its Valves

OIL-REFINERY SERVICE subjects valves to frequent operation, high temperatures and pressures, coking deposits, corrosion and atmospheric attack, and requires, somewhere on the system, valves of every class and type manufactured. Valve maintenance plays a major role in such a plant; the methods used by Standard Oil Co. of New Jersey represent an outstanding example of a thorough-going program.

Inspection

Standard Oil engineers find that frequent inspection not only improves service but also simplifies repair work and reduces to a minimum the number of new parts needed to keep valves in good operating condition.

The regular maintenance department makes all routine inspections of operating equipment. As a precautionary measure, valves carrying corrosive fluids have a small hole drilled through the outer surface to within a predetermined distance of the inner wall. Reduction of body thickness causes leakage through the hole and indicates when valve must be discarded or used on lower pressure. Routine valve inspection includes wall-thickness measurement with direct-indicating calipers.

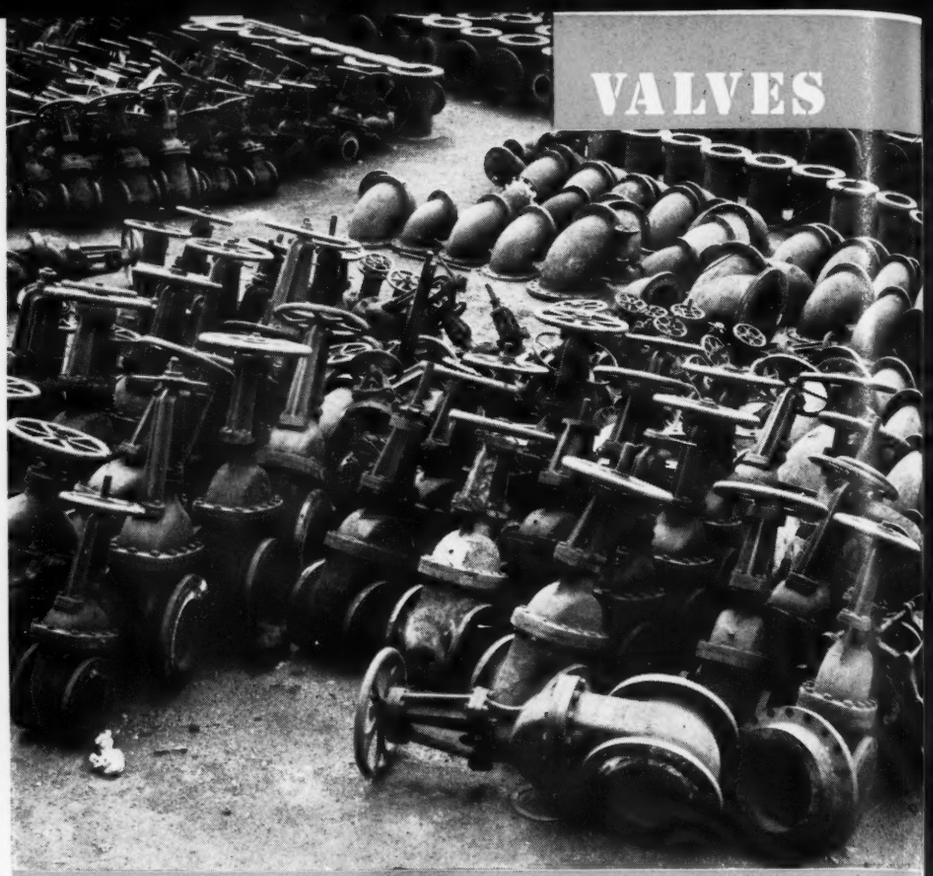
Valves needing repairs are replaced and the faulty units go to the reclamation department. Valves taken from dismantled equipment, during the regular plant rearrangements characteristic of the rapidly changing refining industry, also go to the repair shop for overhaul. This constant inspection and reconditioning reduces the amount of new equipment needed.

Repair

The material reclamation department reconditions all dismantled equipment, including valves, piping, and steel work. One section, with its own shop, handles nothing but valve repairs. The pictures and captions on these pages outline the major operations involved in reconditioning valves.

Flexible repair-shop operation permits routine renovation of valves for

(*Continued on page* 85)



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1

Valves found, by inspection, to need repair, and valves from dismantled equipment, go to this storage area. Repair men work steadily through the pile unless a special unit is needed and given priority over routine work

2

Simple angle-iron fixture, adapted to fit a wide range of valve sizes, holds valve upright for convenient dismantling. Power-driven wrench speeds removal of stubborn bolts

3

Bar through yoke simplifies lifting and handling of heavy valves

4

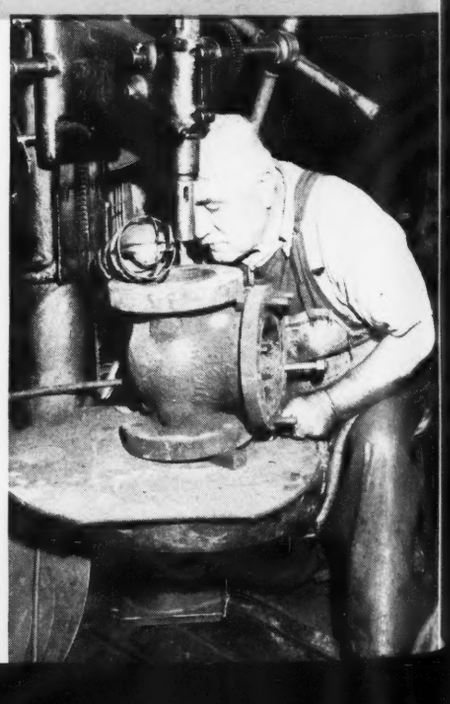
First step in seat grinding involves placing body on drillpress table; wedges under bottom flange provide means of bringing seat surfaces to level position. Pad keeps valve body from slipping

5

Operator centers valve body under drillpress spindle. With machinists' level on seat surface,

4

5



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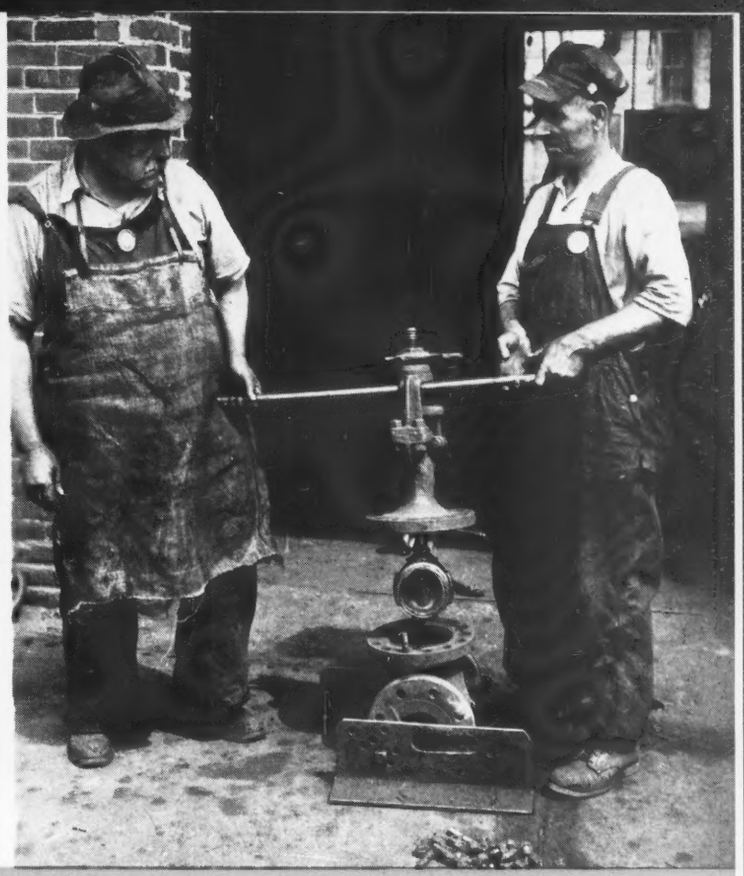


3

wedges are adjusted to bring seats to true horizontal plane. Drillpress spindle must be plumb. This procedure insures retaining original seat angle. Lamp makes level clearly visible. Long bolt through flange bolthole rests against drillpress column to keep valve body from turning during grinding

6

Shop is equipped with emery-cloth-covered metal disks in various sizes to fit all valves normally handled. Emery cloth is cemented to the disk; a square-headed bolt runs through the disk with a nut and washer on the emery-cloth side. A square socket wrench, inserted in the drillpress spindle, engages loosely with the square bolthead to drive the disk. Disk is inserted through the bonnet opening; loose wrench fit insures even bearing on level seat surface

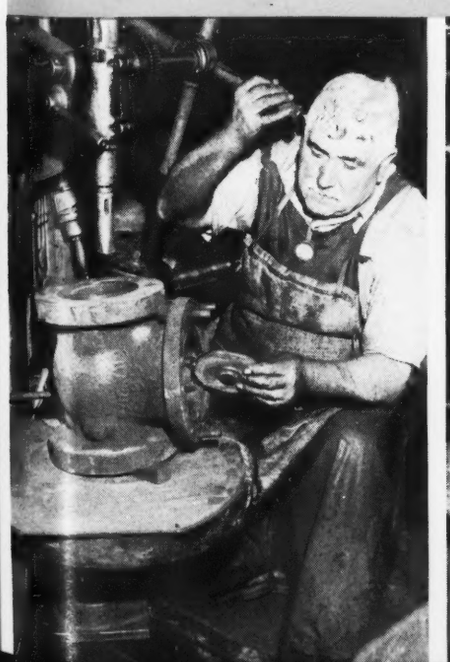
7

With spindle turning at medium speed and light feed pressure, operator grinds seat, stopping frequently to inspect condition of seat surfaces. For seats in bad condition, coarse-grain emery is used, followed by fine-grain emery for finish grinding. Reversing valve body permits facing opposite seat by following the same procedure

8

To reface eroded flange surfaces, operator levels body on drillpress table and grinds with larger disk

6



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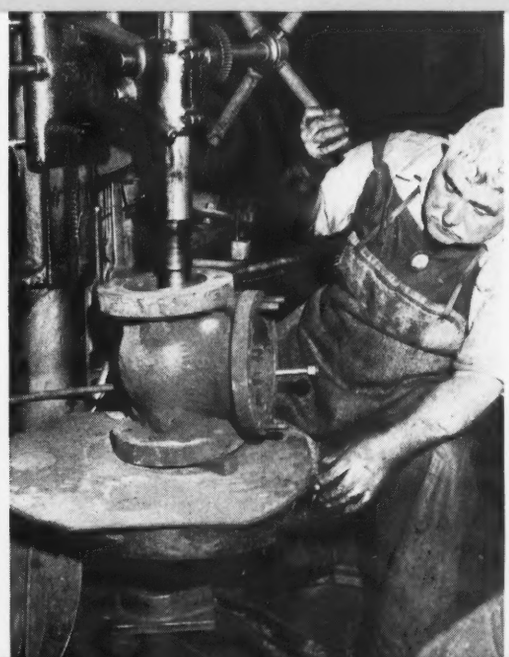

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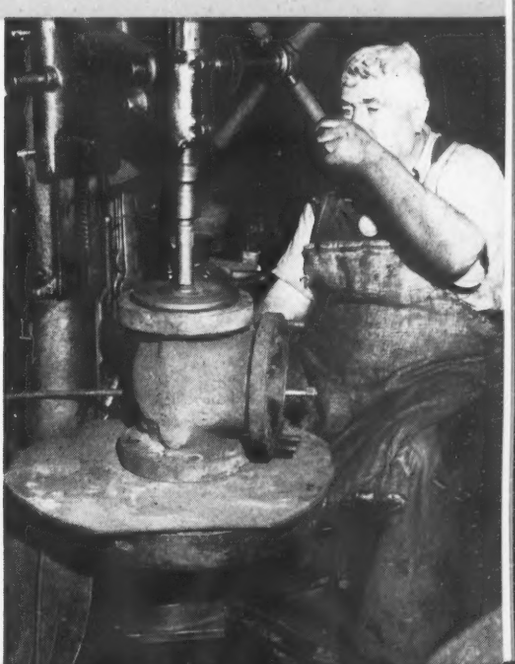

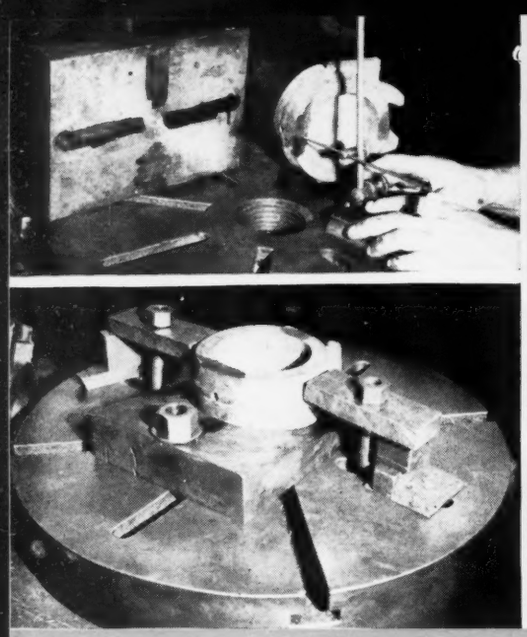

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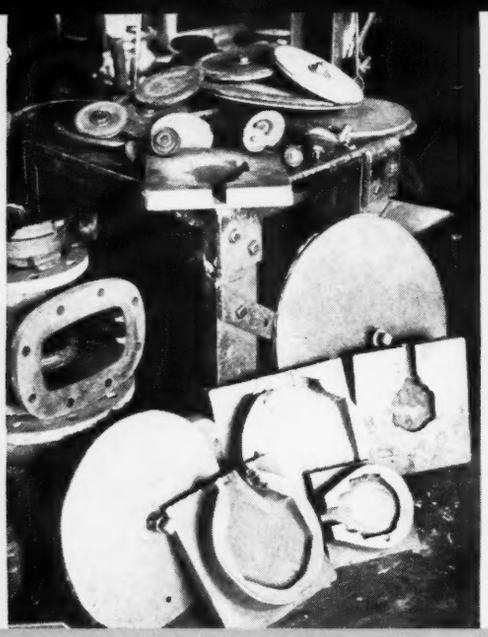

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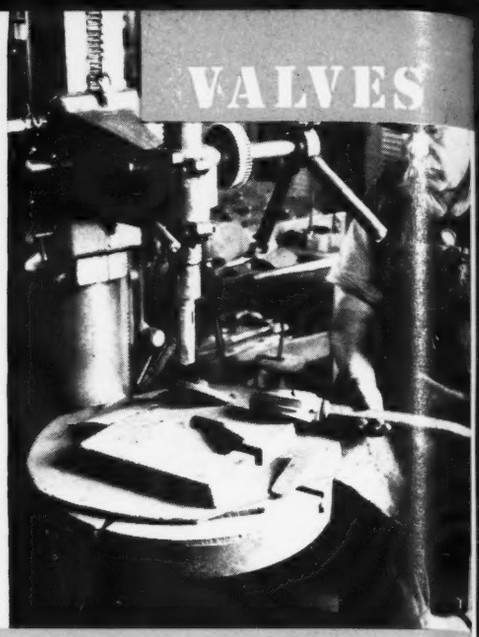


12

9

Wedges which have been built up by welding, or which carry deep scars that require removing considerable metal, are refaced by machining in a lathe. Tapered wedge plate matches disk angle; scribed line indicates true direction of taper. With a surface gage, a centerline is scribed on the disk in the exact direction of its taper. Centerlines scribed at right angles to those previously mentioned help to center disk

10

Taper plate bolts to faceplate slots with center approximately on faceplate center. Clamps hold disk in position on taper plate; scribed lines on disk exactly coincide with scribed lines on tapered plate. It is easier to center disk with faceplate on flat surface than in lathe

11

In this plant, most disks are refaced by grinding in a drill press. Photo shows jigs for holding and leveling gate-valve wedges of various sizes and also some of the assorted emery-cloth-covered grinding disks. Note square bolthead projecting from disk in foreground. As previously stated this bolthead fits loosely in the square socket wrench inserted in drillpress spindle

12

First step in refacing gate wedges: Operator places holding jig on table, at approximate center. With spindle plumb and table level, jig holds disk with face in horizontal plane. For accurate work, jig must be clean and must fit disk outline snugly. This complete procedure insures retaining original disk-face angle to match seat angle

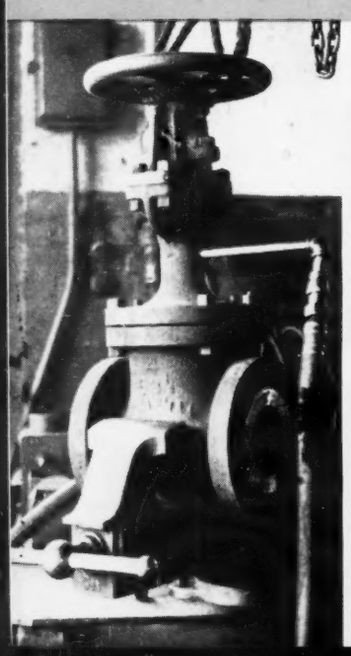
13

With disk in jig and stem in slot, operator applies light feed pressure and grinds face. Friction between heavy jig and rubber pad keeps disk from turning; operator can hold stem if necessary. To grind other face of disk, operator merely reverses the disk in jig

14

After grinding, operator carefully cleans seat and disk and mounts body in vise. With disk surfaces coated with oil or Prussian blue, disk is slammed home to check fit. If oily or blued surface shows poor contact, operator grinds disk to fit. Several refacings may remove so

15



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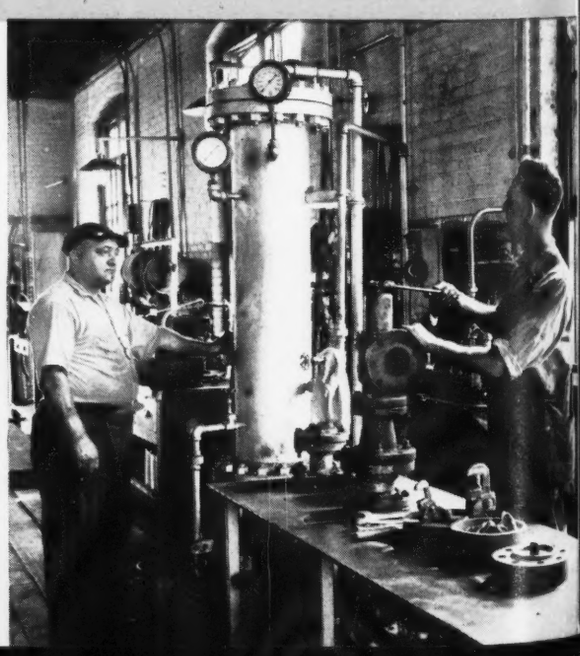
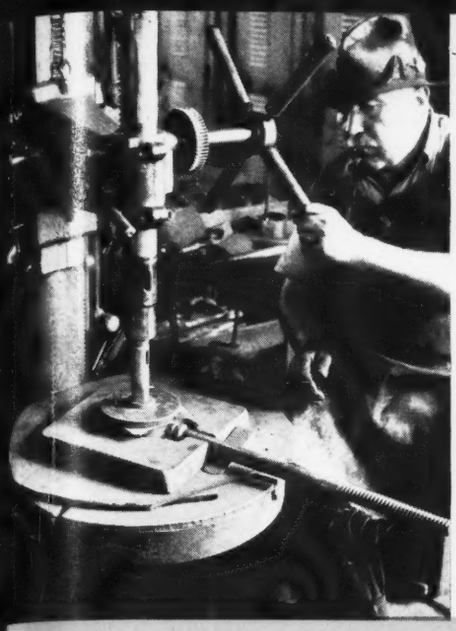
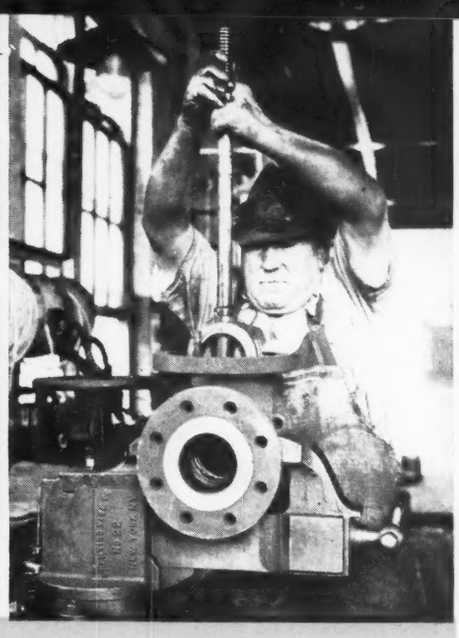




13

much metal that disk travels past proper seating position. In this case, seats are removed and backed with thin washers. After seats are replaced, further grinding is necessary for alignment



14

shows vise made from piece of channel iron and bonnet and stem assembly. Grinding disk is mounted at end of flexible shaft driven by motor suspended over bench. Disks are refaced in lathe

15

Valve is reassembled and new packing added if needed. Air pressure applied to bonnet through previously drilled hole, as shown, tests seats, bonnet joint and packing for tightness. Air leakage, indicated by sound, can be located by applying oil at suspected point. 100-psi air is used, but experience shows lower pressure detects leaks satisfactorily

16

This plant uses few globe valves and only in small sizes. Photo

17

This test setup checks globe valves and safety valves. Air pressure of 100 psi is available; hydraulic pump furnishes pressure to 1700 psi. With adapters provided, valves of any size can be connected to either air or water headers, to check tightness, to set relief pressures and to check or adjust blowdown range on safety valves

18

F. Buchner, shop foreman, stands beside valves which have been repaired by the methods described

18

(*Continued from page* 82)

general stock purposes or immediate overhauling of specific units needed quickly. If a required valve is not in the store room, a call to the repair shop immediately starts a check through the valves awaiting inspection and repair. If a suitable valve is located, it is completely overhauled and sent out to the job.

Shop equipment consists of two drill-presses, a bolt threader, motor-driven flexible-shaft reseater, variable-pressure test bench, seat wrenches and necessary grinding disks and jigs for holding valve parts. Spare parts such as seat rings, gaskets, and parts from discarded valves are stored in small accessible bins. Years of experience prove that even with a large number of valves in use, a large supply of individual parts is unnecessary.

Shop-made jigs and grinding tools speed refacing jobs. For holding gate-valve wedges, jigs are made by milling out tapered recesses in solid plates or by tapering a plate to wedge shape and then welding on inclosing walls. These jigs (see photos and captions for method of use) hold wedges snugly and maintain proper seating angle. Taper plates also facilitate refacing operations in the lathe (see photos).

Welding

When new seat metal must be added to wedges, the welded-on overlay is applied to one side at a time. This permits using the opposite side as a bearing against the taper plate during machining and insures maintaining the proper wedge angle. After one face is welded and machined, the opposite side is completed in the same manner. Building up both faces before machining introduces the possibility of destroying the wedge taper. Because need for welding and lathe work is rare, the main machine shop carries out these infrequent jobs.

Safety and relief valves for high-pressure and high-temperature service require extremely careful workmanship when grinding the seats. Many of these valves have flat seating areas of fairly small area. Coarse grit or unevenly applied pressure can do greater damage to the seat than was found on inspection. For these valves Standard uses a grinding compound of extreme fineness applied to the work on a special hardened lapping disk. No additional pressure, over that of the disk weight, is applied during the lapping process. The lapping disk has a true plane surface which eliminates any necessity of lapping the seat and valve disk against each other.

Hard-Facing Protects Valve Trim Against Wear

HARD-FACING OFFERS a useful maintenance tool for protecting steel valve parts against severe abrasive wear and wiredrawing action. Cobalt-chromium-tungsten alloys (Stellite) retain their hardness at red heat (see curve below, at right) making them particularly suited to surfaces in friction and to parts exposed to high temperature.

Before applying hard-facing alloy, prepare the part by grooving the surface to a depth of from $\frac{3}{32}$ to $\frac{1}{8}$ in., leaving a ridge on each side. Round off all sharp corners because sharp edges melt easily and inter-alloying between base metal and hard-facing alloy might occur. Such "dilution" results in decreased wear resistance and frequently causes blowholes. If the seat or part is too narrow for grooving, machine it flat and round off the edges. After grooving, clean the surface thoroughly, removing all dirt, scale, or grease.

If the part is small, say under 3 in. dia., and the welding flame is large enough to keep it red hot during welding, no furnace preheating is necessary; preliminary heating can be done with the torch. Larger parts require preheating with several torches or in a temporary furnace (see dwg). Raise temperature slowly to 800–1200 F, or just under the point where steel begins to scale. This is a faint red heat, just visible in a dark room.

Maintain Heat

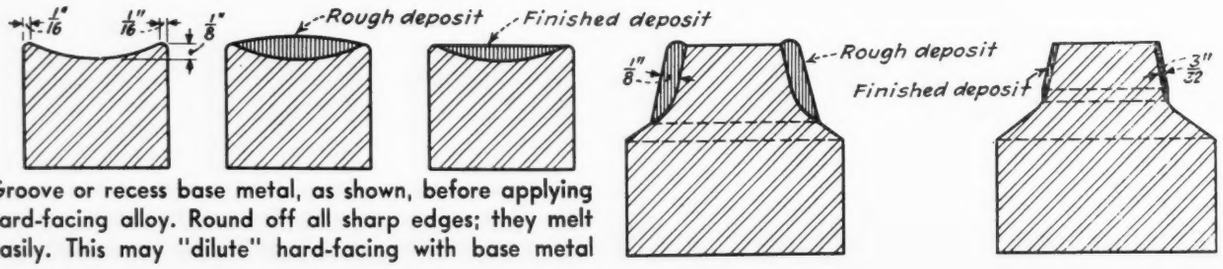
If possible deposit the alloy while the valve part is in the furnace; when this proves impractical, reheat whenever part cools to 600 F. Fixtures can be purchased or made that will rotate the work during the hard-facing. Such a device is not absolutely necessary; a helper can turn the part.

Hard-facing requires an excess acetylene flame. Adjust acetylene feather length, measured from blowpipe tip, to three times the inner-cone length, measured from welding-tip end. This flame prepares steel by melting an extremely thin surface layer, giving steel a watery, glazed appearance called "sweating". This sweating, produced only by an excess acetylene flame, is necessary for successful hard-facing on steel.

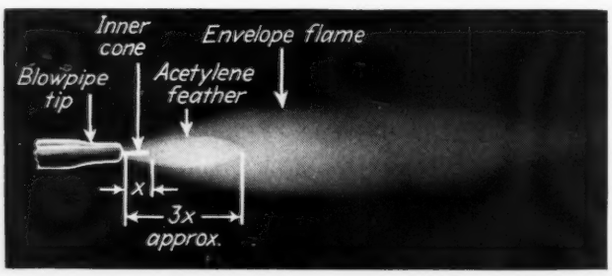
Torch Angle

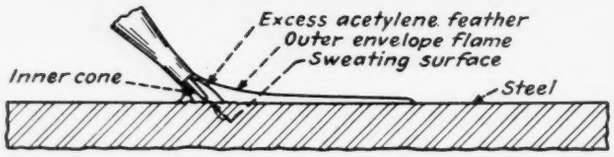
Hold the torch to direct the flame at a 30–60 deg angle to the surface, with inner-cone tip about $\frac{1}{8}$ in. from steel. Keep this position until steel under flame suddenly glazes. Extent of sweating area varies with size of welding tip, but for a medium tip steel will sweat about $\frac{1}{4}$ in. around flame. Withdraw torch slightly and bring welding rod between inner cone of flame and steel surface. Inner-cone tip should almost touch rod and rod should lightly touch sweating area. Melting of rod forms a

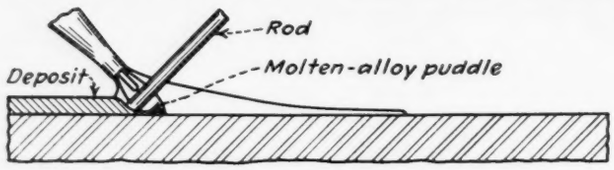
PROPER PREPARATION MEANS GOOD HARD-FACING

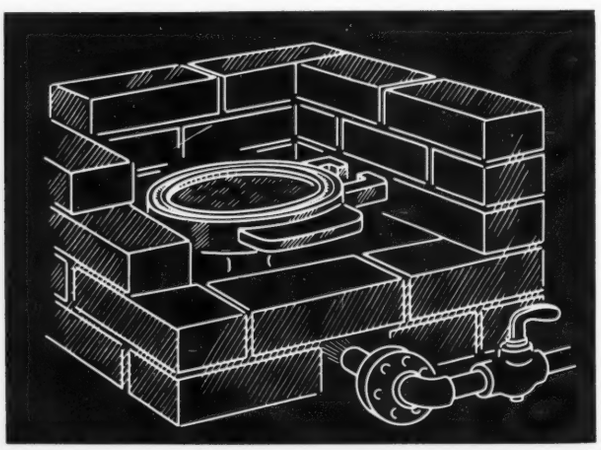


Groove or recess base metal, as shown, before applying hard-facing alloy. Round off all sharp edges; they melt easily. This may "dilute" hard-facing with base metal









Simply made firebrick furnace, oil- or gas-fired, will preheat large parts. Charcoal can also be used as fuel

Picture (above, left) shows excess acetylene flame used for hard-facing. Sketches (below, left) show torch held close to work to "sweat" surface, and position of rod

puddle on steel. If first few drops foam or bubble, or do not spread evenly, steel is too cold and should be brought to recommended temperature.

Some steels foam slightly when brought to sweating heat. When this occurs, do not deposit metal until foaming stops. If deposit is started before foaming is noticed, direct torch at foaming spot and agitate molten metal with flame until foaming stops. Depositing metal during foaming causes blowholes and poor results.

To spread molten alloy over area, remove rod from flame and direct flame into puddle. Return rod and melt off more alloy as required. Now direct flame so that it plays partly on edge of puddle and partly on adjoining steel surface. As steel approaches sweating heat, puddle of hard-facing alloy spreads. As it spreads, bring rod quickly into flame again to add more metal as needed. If any dirt or scale appears on steel or in puddle, float it to surface with flame or dislodge it with end of welding rod.

With a little practice the right amount of alloy can be added to make the desired thickness. It is better to do this in one operation than to go back over the entire job to add another layer. During the operation, move the flame back to melt a thin surface layer of the deposit, to smooth out high spots as the work progresses. Do this quickly, without letting the front edge of the puddle solidify and without interrupting steady forward travel of work. After completing deposit, use flame to smooth out remaining rough surfaces. On this second pass, take care to melt only hard-facing surface and not base metal. This avoids bringing iron from base metal to the hard-facing deposit.

Prevent Cracks

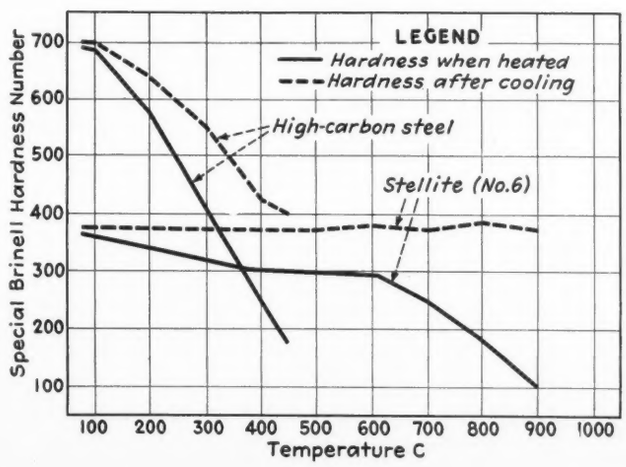
When deposit reaches desired size and thickness, remove flame slowly to prevent formation of shrinkage cracks and blowholes. If these occur, remelt deposit and remove particles of scale from pool. If holes still show, grind alloy deposit down to steel, heat area with flame, gradually, and deposit additional metal. Make sure that no slag, dirt or scale is covered or embedded in the deposit to cause pinholes.

Slow cooling is absolutely essential to produce a deposit free from cracks and internal stresses. Parts showing a strong tendency to crack, such as large gate-valve wedges and seat rings, or parts on which deposit is circular or large in area, should be returned to preheating furnace while still hot from welding. Bring them slowly to a low red heat, then let them cool in the furnace. If a furnace is not available, place the part in dry powdered lime, ashes, or other insulating material, so that at least 2 in. of material covers and protects every point of the part.

Some alloy steels used for valve trim require heat treatment in order to maintain corrosion resistance. When this is necessary, follow the steel manufacturer's instructions with but one exception: never cool hard-faced parts by quenching in water or in an air blast. This will set up strains and cause cracks in hard-facing. If quenching is considered necessary, use only oil.

After the hard-faced part has cooled, excess metal must be removed. This can be done by grinding or by machining with a tungsten-carbide tool.

HARD-FACED SURFACES RETAIN HARDNESS AT RED HEAT



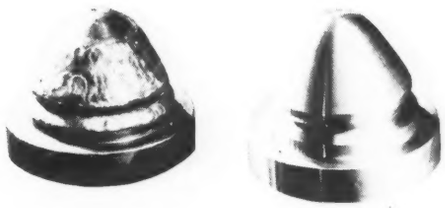
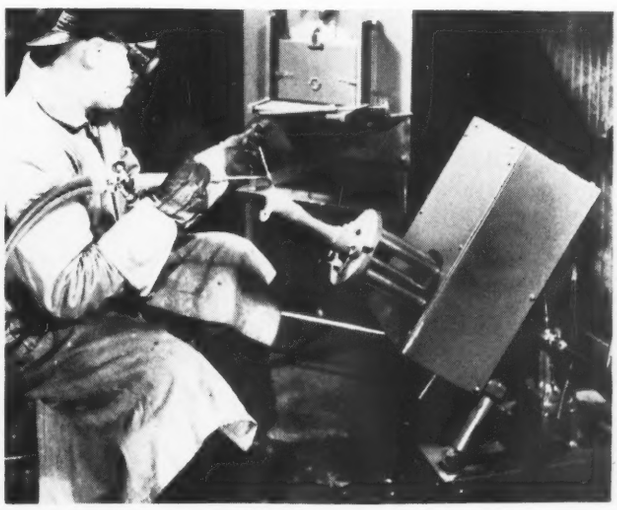
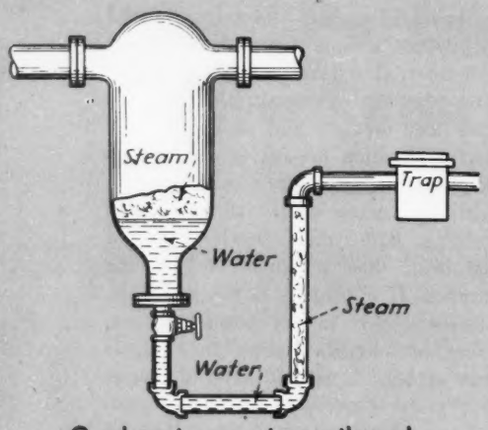


Photo (below, left) shows hard-facing, with helper prepared to turn work while using torch to maintain metal temperature. Device (below) rotates work automatically. Photos (above) show plug disks before and after grinding. Chart compares properties of Stellite and carbon steel

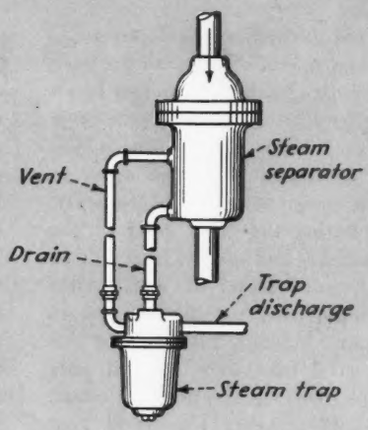


FOLLOW THESE POINTERS WHEN INSTALLING TRAPS

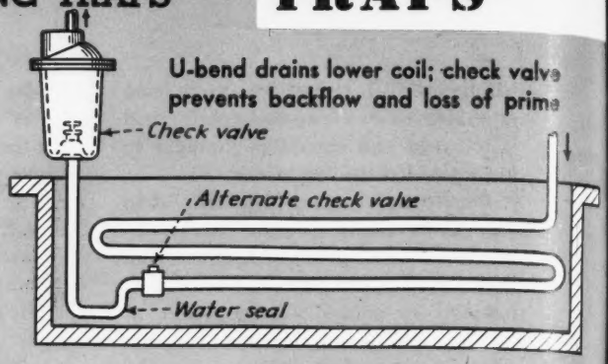
TRAPS



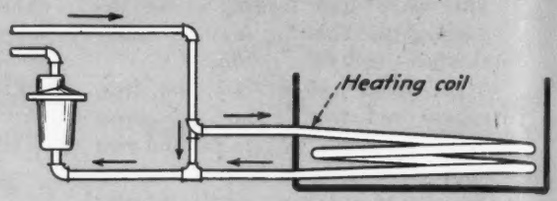
Condensate cannot pass through U-bend until steam condenses

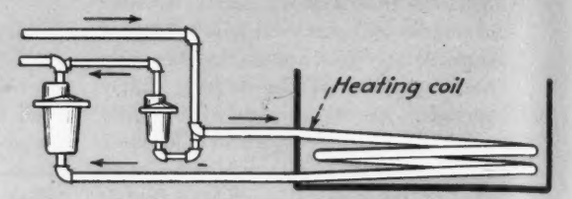


Vent pipe prevents choking and speeds removal of condensate

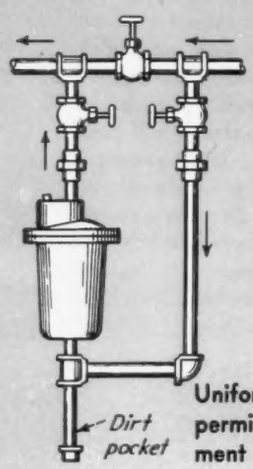


U-bend drains lower coil; check valve prevents backflow and loss of prime

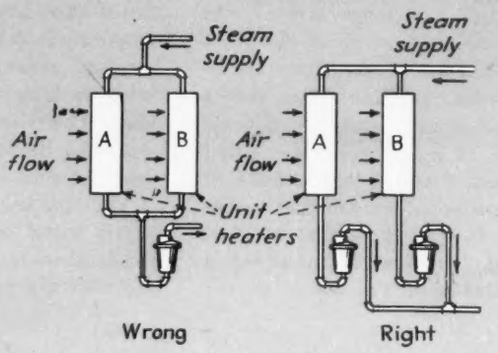




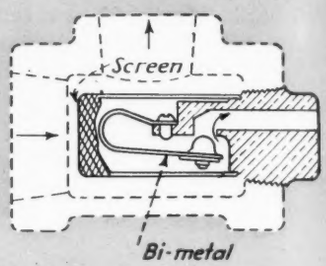
Don't short-circuit heating coil with a crossover; use separate trap on header



Uniform connections permit quick replacement when traps fail



Use trap for each heater, to avoid short-circuiting



Thermostatic drains prevent freezing when steam is turned off

Maintenance Insures Reliable Trap Operation

ON TRAPS TOO, good operation and low-cost maintenance starts with proper installation. For example, hard-to-get-at traps will be neglected; easy access encourages regular inspection. If trap is exposed to low temperatures, protect it against freezing. Install thermostatic drains in trap or piping inlet to release all water when pressure is shut off and the condensate temperature falls.

Trap location directly affects operation. Wherever physically possible, install traps below equipment to be drained, so condensate can flow by gravity. Avoid U-bends or water seals; they obstruct free flow and cause "steam binding". A slug of water flowing toward the trap immediately after discharge lies in the pocket until steam, remaining beyond the pocket and in the trap chamber, condenses.

Where traps must be installed above equipment to be drained, install a check valve and water seal or U-bend in the connecting piping. The check prevents backflow and loss of prime and also prevents back drainage from a common return header, or entrance of air when unit is shut off. The water seal, although acting as an obstruction, serves as a sump for condensate collection, allowing it to be carried to the trap in slugs. Without the seal it would be possible for the bottom coil to remain partly filled with condensate.

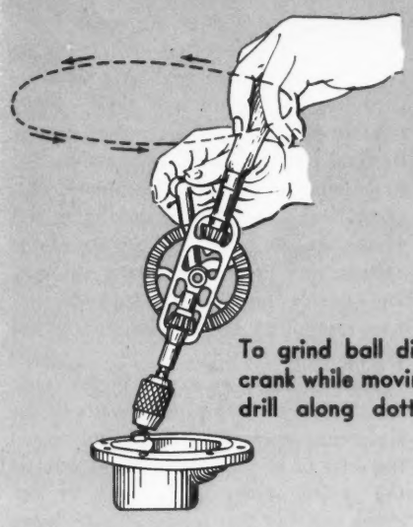
Where traps discharge into common lines and connections do not require a check valve in the inlet line, a check in the discharge prevents backflow from other units or drainage back to an idle unit when the trap has an individual overhead discharge line.

Even when condensate flows vertically downward to a trap, a heavy rush of condensate chokes the line, prevents backward escape of trapped steam and requires time for steam to escape or condense before water enters the trap. Although obstructing bends installed on steam lines only delay trap action, more serious trouble occurs on air lines unless the trap vents back to the vessel being drained. Such vent lines can be used only when the trap stands below the drained equipment.

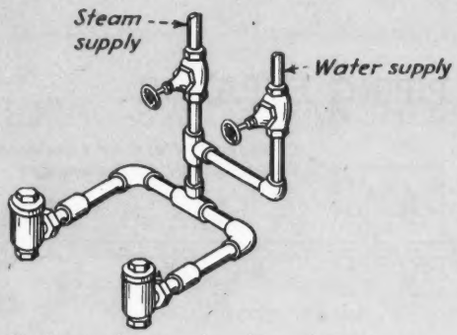
If allowed to enter traps, pipe scale and sediment prevent tight seating and cause blow-through. Cleaning the pipe before installation fails to protect fully because temperature changes and flow loosen other particles. Install a strainer ahead of the trap or, if this is not possible, fabricate a "dirt leg" from pipe, to act as a catch pocket (see drawing).

Uniform piping connections help in removing or exchanging traps for inspection and repair. Test valves and a tee in the discharge from each trap facilitate checking trap action. Installing a bypass around the trap permits adequate drainage and removal

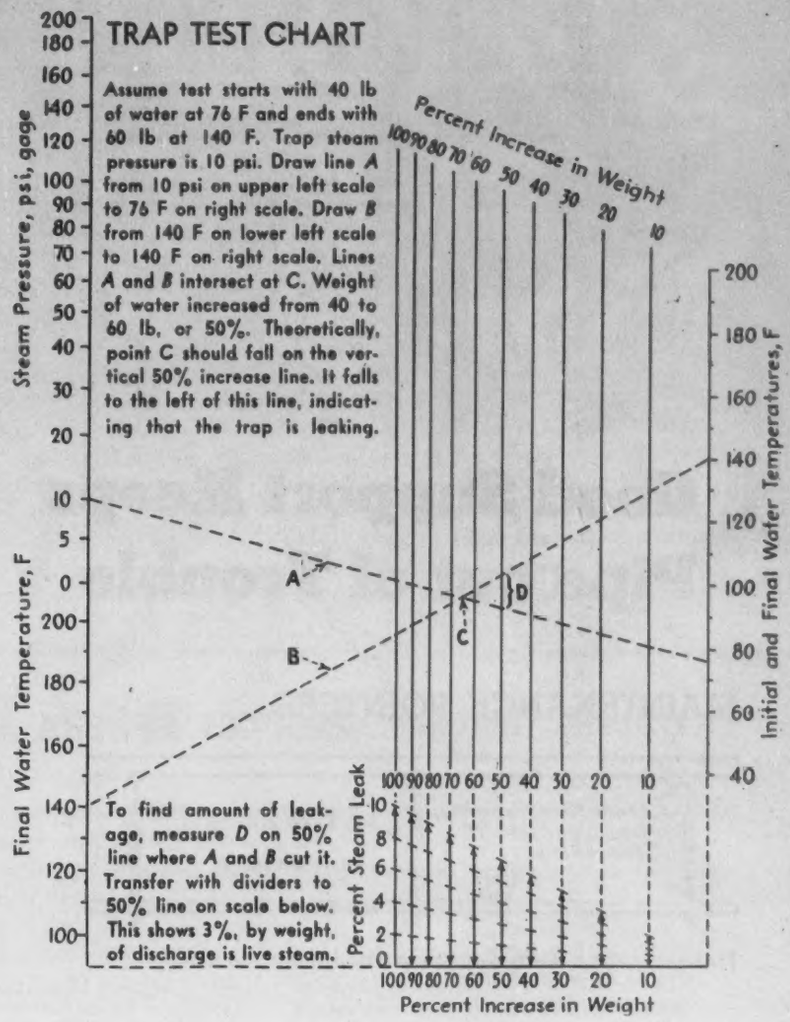
SIMPLE TESTS AND REPAIRS KEEP TRAPS IN TOP CONDITION



To grind ball disks turn crank while moving hand drill along dotted line



Steam and water header setup for convenient trap testing


TRAP TEST CHART
Assume test starts with 40 lb of water at 76 F and ends with 60 lb at 140 F. Trap steam pressure is 10 psi. Draw line A from 10 psi on upper left scale to 76 F on right scale. Draw B from 140 F on lower left scale to 140 F on right scale. Lines A and B intersect at C. Weight of water increased from 40 to 60 lb, or 50%. Theoretically, point C should fall on the vertical 50% increase line. It falls to the left of this line, indicating that the trap is leaking.
To find amount of leakage, measure D on 50% line where A and B cut it. Transfer with dividers to 50% line on scale below. This shows 3%, by weight, of discharge is live steam.
Steam Pressure, psi, gage
Final Water Temperature, F
Initial and Final Water Temperatures, F
Percent Increase in Weight
Percent Steam Leak
A
B
C
D

for repair when no spares are available.

Most traps include a valve, an operating device (bucket, float, bellows, etc) and, if necessary, a linkage and bearings between valve and operator. Trap maintenance usually involves cleaning to remove foreign matter that might interfere with valve or linkage action, reseating valves when necessary, removing lost motion from linkage, and renewing the body gaskets.

Moving parts located inside the body, in contact with moisture, offer lubrication difficulties and may show considerable wear. Excessive wear and lost motion, if allowed to continue, prevents positive operation and may reach the stage where the valve no longer seats.

Normal wear of some valves gradually enlarges the seat area at point of disk contact. This increases the surface acted on by differential pressure across the valve, making it more difficult to operate. The area may increase to such an extent that the operating device is no longer powerful enough to move the valve. When this happens the valve must be refaced to regain the original area.

Whenever a trap fails to operate, and the reason is not readily apparent, observe the trap discharge by opening a test cock or breaking the discharge connection. Live steam usually indicates a leaking valve; it may be caused by the trap losing prime. Failure to discharge can be caused by a leaking bypass valve, inlet piping or trap obstructed by sediment and pipe scale, return line too small, or obstructed outlet.

Valve leakage represents a common cause of trouble; worn seats are not so much to blame as are particles that prevent tight closure. Other trap troubles include rusting and sticking of mechanism, lost motion in linkage, gasket and connection leaks, float leaks and bent lever arms. Wear in levers and pins of a continuous-discharge trap causes intermittent operation. For most of these difficulties, simple mechanical remedies suffice, once the cause of the trouble is spotted.

When valves do not seat properly yet appear to be in good condition, check linkage and stem length. Repeated regrinding may have shortened the stem. Make adjustments of stem length at or near full operating temperature.

There are numerous ways of checking trap operation. A slight temperature difference between inlet and outlet indicates a working trap; no difference indicates a leaking trap; a large change in temperature indicates no condensate passing. Intermittent-discharge traps produce a light clicking sound at each operation; constant-discharge traps can be checked with a listening rod or stethoscope applied to the trap body.

When visible discharge is not satisfactory evidence, passing the discharge into a vessel of water forms a positive test. Weigh original quantity of water and check its temperature. After discharge, weigh water again and check temperature. Heat given up by trap discharge in falling to final temperature equals heat gained by original water quantity rising to same temperature. The chart above simplifies computations, eliminating use of steam tables.

SUPPORTS INSULATION

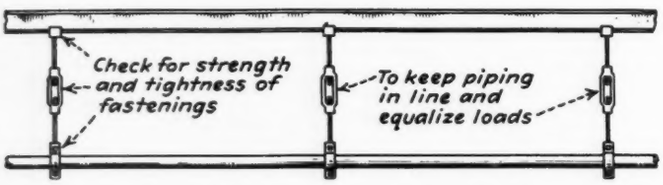
Good Support Keeps Pipe out of Trouble

AN IDEAL PIPING SYSTEM would float like a layer of logs on a smooth pond, each part self-supported and laying no stress on any other part. All elements in the system would hold their correct relative positions and alignment despite thermal expansion and contraction. Actual first-class systems approach this theoretical ideal by the intelligent use of anchors to fix certain points of the system, and expansion joints, supports and guides to combine support with free movement for all the rest of the piping in the system.

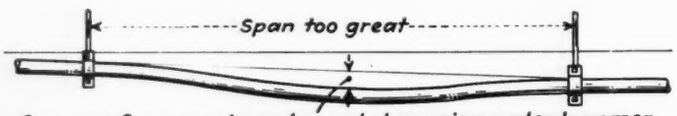
Without being an expert in the mathematical design of piping systems, the maintenance man should understand the duty to be expected of each part of the system under his care so he can check whether that job is actually being performed as it should.

First take the system as it stands,

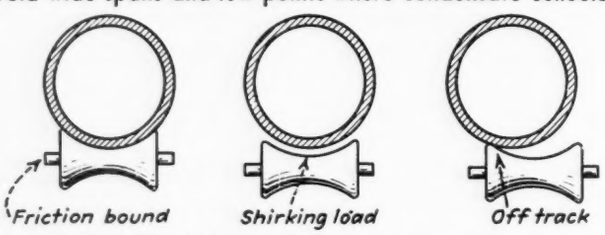
MAINTENANCE POINTERS



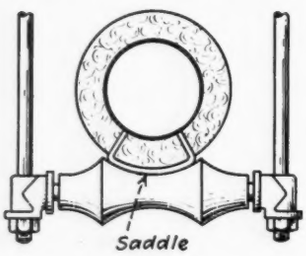
Hangers must maintain alignment and share the load



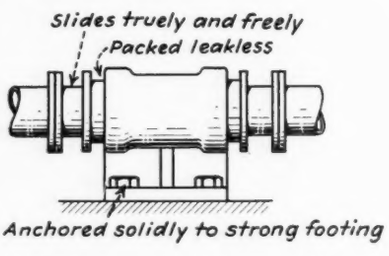
Avoid wide spans and low points where condensate collects



Watch for rollers shirking load or not tracking true

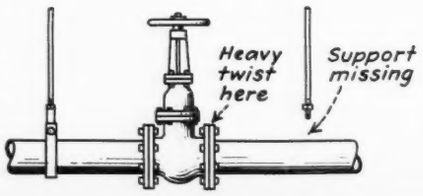


Use special fittings to keep load off covering

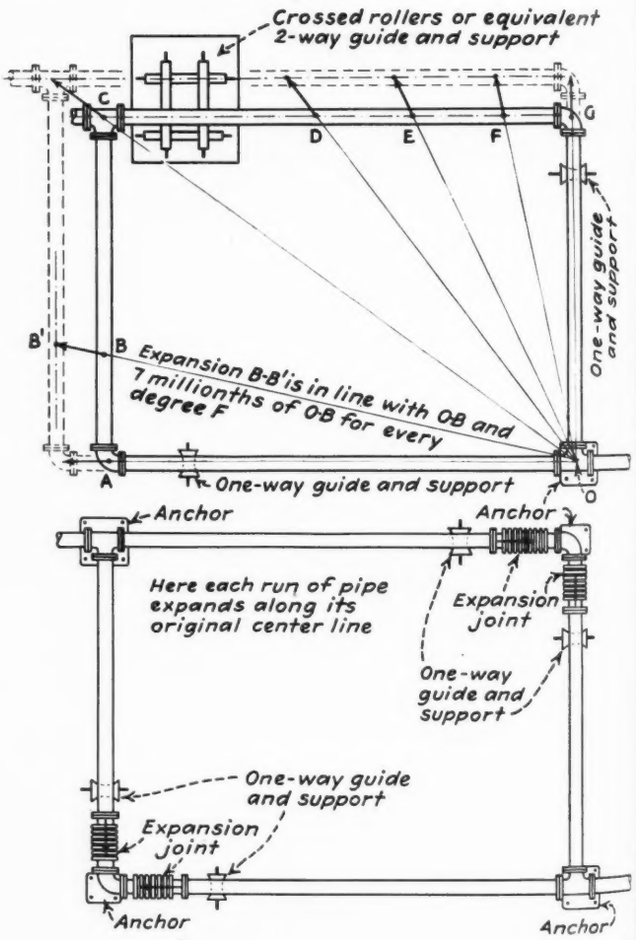


Watch expansion joints, anchors

Be sure piping hangs on hangers, not on valves. Excessive strain may warp or damage valve bodies



HOW PIPING EXPANDS



For every degree Fahrenheit temperature rise, iron or steel expands approximately 7 parts per million in all directions. If the simple system at the top were completely rigid, and supported and anchored as shown (supports friction free), it would expand radially in all directions from the anchorage without setting up any stresses in piping. However, anchoring one point only is generally impracticable because of equipment location, friction of supports, etc. In the system below, every straight run has its own anchor and expansion joint so that pipes slide in and out along the original centerlines

See example above

cold or at some fixed temperature. Anchors should securely lock the anchored points in the piping to heavy steelwork or other dependable footing. Between each pair of anchors should be an expansion joint or bend designed to absorb all possible movement from temperature differences.

Pipe supports should be spaced closely enough to prevent undue sag in the span. All steam and air lines should be properly pitched for condensate drainage and checked to make certain that sag does not bring the centerpoint of any span below its lower support, thus forming a condensation pocket leading to water hammer and other troubles.

Check each hanger or other support to make sure that it carries its share of the load, that pipes track truly on fitted rollers or other guides, that supports and their attachments are amply strong for the load and set to carry the weight, yet permit free pipe movement in the direction of expansion.

To avoid trouble these conditions should be met whether the line is hot or cold. To make a single set of adjustments serve for both extremes of temperature is a most difficult job both for the designer and the maintenance engineer. One requirement is an understanding of thermal expansion, and here are the main points:

When an unrestrained steel body is uniformly heated no forces whatever are set up, either internal or external. The body expands gently and proportionately in all directions. Thus, if a piping system is completely unrestrained except that the weight is carried at all points by fully "floating" supports, heating to a higher temperature will produce no forces whatever, nor any change in the *proportions* of the layout. All dimensions will be slightly increased, as if the new layout were a slightly enlarged photograph of the original.

The coefficient of expansion for any grade of iron or steel is approximately 0.000007 per degree F. This simply means that the expansion is 7 parts per million per degree. For example, if the temperature of a steel pipe is raised by 400 F, its length will increase by about 400x7=2800 parts per million, or about 0.28 in. per 100 inches.

The coefficient of expansion varies somewhat with the actual temperature, so expansions should be taken directly from a table like that shown on the next page if accurate results are desired.

The illustrated example shows how to figure the expansion in various

PIPING-SYSTEM ANCHORS MUST ABSORB EXPANSION-JOINT THRUST

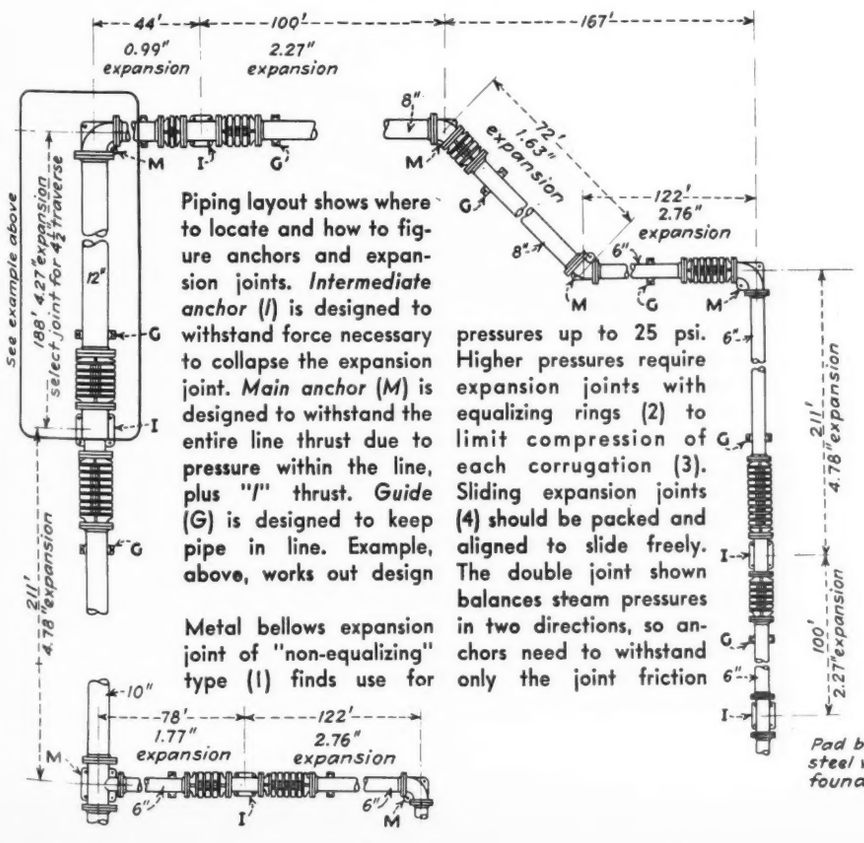
EXAMPLE: If 188 ft of 12-in. steel pipe installed at 60 F operates at 340 F and 100 psi, find (Problem 1) *Expansion*, (Problem 2) *Anchor thrust "I"*, (Problem 3) *Anchor thrust "M"*.
Problem 1 — *Expansion:* Total expansion in 100 ft:

at 340 F = 2.862 in.
at 60 F = 0.593 in.
Difference = 2.269 in.
Expansion = 2.269 x 1.88 = 4.27 in.

Problem 2 — *Intermediate anchor thrust "I"* (Force required to collapse expansion joint is pipe diameter times 200 for corrugated copper joint or 300 for steel)

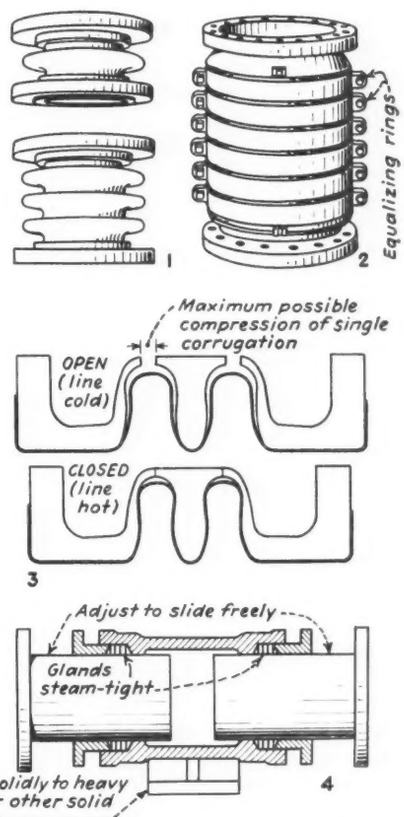
12 x 200 = 2400 lb (copper)
12 x 300 = 3600 lb (steel)

Problem 3 — *Main anchor thrust "M"* (Anchor thrust *"I"* plus line thrust due to pressure within line. Latter equals operating pressure times area of largest diameter of corrugation)
Area of largest corrugation of 12-in. joint = 240 sq in.
240x100 = 24,000 lb
M (c'p'r) = 24,000 + 2400 = 26,400 lb
M (steel) = 24,000 + 3600 = 27,600 lb
Note: All apparatus, valve points, ends of line, as well as points where line changes direction, should be anchored against *"M"* thrust



Piping layout shows where to locate and how to figure anchors and expansion joints. *Intermediate anchor* (*I*) is designed to withstand force necessary to collapse the expansion joint. *Main anchor* (*M*) is designed to withstand the entire line thrust due to pressure within the line, plus "*I*" thrust. *Guide* (*G*) is designed to keep pipe in line. Example, above, works out design

Metal bellows expansion joint of "non-equalizing" type (1) finds use for pressures up to 25 psi. Higher pressures require expansion joints with equalizing rings (2) to limit compression of each corrugation (3). Sliding expansion joints (4) should be packed and aligned to slide freely. The double joint shown balances steam pressures in two directions, so anchors need to withstand only the joint friction



lengths of pipe. It also shows where anchors must be located and what forces they must be designed to carry. Incidentally the steel self-equalized corrugated expansion joint pictured may be used up to 200 or 300 psi. Pipe bends may be used for all pressures.

With either corrugated-metal or well lubricated sliding expansion joints, the forces to be handled by the anchors are substantial, but much less than with the expansion pipe bends commonly used for the higher pressures. Figuring such bends is a rather mathematical branch of design engineering, but the maintenance engineer may be able to learn from the designer how much force the bend exerts for each inch of compression as the connected piping expands.

Expansion

When piping is heated the piping moves straight out from the anchor by an amount proportional to the temperature rise and to the distance from the anchor. In an elaborate piping system many complications can arise. If a long horizontal run without an expansion joint ends in a riser, expansion will push the riser out of plumb unless the top end is so suspended that it can move out too. If the weight of a riser, when cold, is equally distributed over several rigid hangers, one above the other, heating the line will expand the pipe and thereby unload all upper hangers, shifting the entire load to the bottom hanger.

Many other similar effects will be observed, and generally can be sized up on the spot by the exercise of mechanical common sense.

Here are some practical points to remember: Supports for a horizontal pipe far from an anchor must allow ample roll, slide or swing in the direction of the pipe expansion. If temperature changes cause any piping (whether horizontal or vertical) to rise and fall, such sections must be carried on properly designed spring supports.

For large movements in a vertical direction, the springs must be "soft." Such springs permit a substantial up-and-down movement with only a moderate change in the support delivered to the pipe.

Maintenance of a piping system will naturally start with obvious ills—leaks, water hammer, swaying and vibration. Leaks may be caused by joints improperly designed or made up (see page 67), by expansion forces or improper support. Piping should always be supported on both sides of every large valve. Where leaks persist or recur despite good joint technique, check alignment and condition of neighboring anchors, supports and expansion joints to make sure the leak is not caused by external forces.

Other common causes of leaks are pipe swaying and water hammer. Water hammer may result from pulsating pumps or the too-quick closing of valves. A common cause, traceable to poor maintenance, is undrained condensate caught in low points of the piping, back of globe valves, etc. Check system to make sure that low points are raised and all other pockets drained. Sags caused by misalignment can usually be cured by simple hanger adjustments.

When all such obvious ills have been cured, the job shifts to preventive maintenance—regular routine inspection to make sure that anchors are holding and showing no signs of breaking or slipping, that walls and footings near anchors are not showing distress cracks, that sliding expansion joints are not leaking on the one hand or sticking on the other, that supports everywhere are in line with pipe and tracking true, that supporting rolls turn freely and support their share of the load whether the line be hot or cold, that bolts, turnbuckles and other stressed members give no sign of distress or possible early failure.

THERMAL EXPANSION OF STEAM PIPE

(Condensed from table in "Piping Handbook" by Walker and Crocker)
Table gives total expansion above minus 20 F in inches per 100 ft of pipe. To get expansion per 100 ft between two given temperatures, subtract tabular value for lower temperature from that for higher

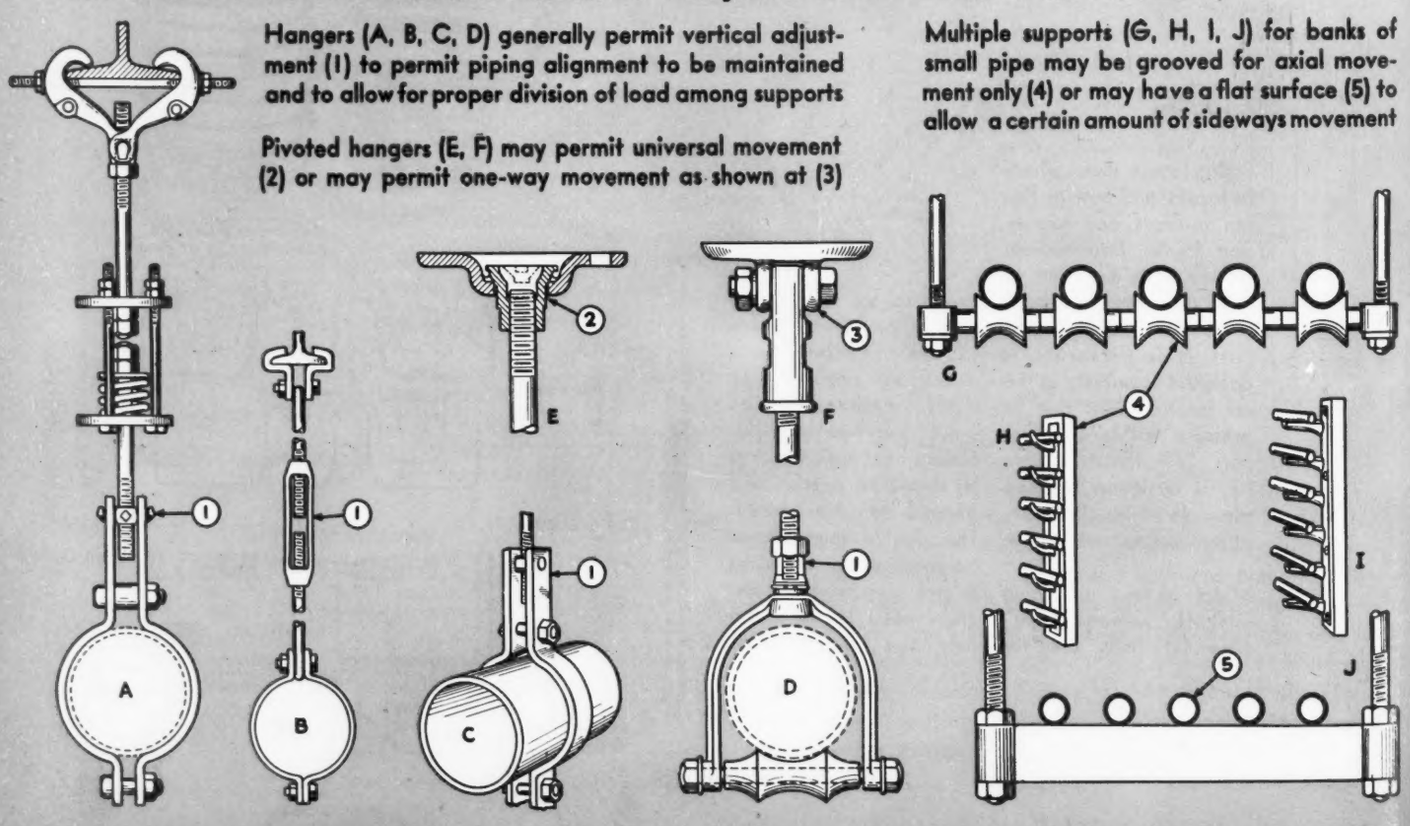
Temp, F	CI pipe	Steel pipe	WI pipe	Copper pipe
— 20	0	0	0	0
0	0.127	0.145	0.152	0.204
100	0.787	0.898	0.939	1.338
200	1.495	1.691	1.778	2.500
300	2.233	2.519	2.630	3.665
400	3.008	3.375	3.521	4.870
500	3.847	4.296	4.477	6.110
600	4.725	5.247	5.455	7.388
700	5.629	6.229	6.481	8.676
800	6.587	7.250	7.508	9.992
900	7.579	8.313	8.639	11.360
1000	8.617	9.421	9.776	12.747

TYPICAL PIPE SUPPORTS PERMIT ADJUSTMENT AND MOVEMENT

Hangers (A, B, C, D) generally permit vertical adjustment (1) to permit piping alignment to be maintained and to allow for proper division of load among supports

Pivoted hangers (E, F) may permit universal movement (2) or may permit one-way movement as shown at (3)

Multiple supports (G, H, I, J) for banks of small pipe may be grooved for axial movement only (4) or may have a flat surface (5) to allow a certain amount of sideways movement



Maintain Insulation to Save More Heat

THE GOOD MAINTENANCE MAN keeps insulation in perfect condition because necessary inspections and repairs save many times their cost in fuel. Here are practical pointers on maintaining and repairing covering of piping, valves and fittings—chiefly those containing steam or hot water.

A good job of hot-pipe insulation will have the following characteristics: (1) efficient insulating material applied to economic thickness, (2) material able to stand ordinary handling, (3) inner layer able to stand pipe temperature, (4) insulation bound securely to pipe, (5) joints closely fitted and staggered (if double layer), (6) insulation well covered and painted, and (7) complete waterproofing for outdoor or underground lines.

Materials

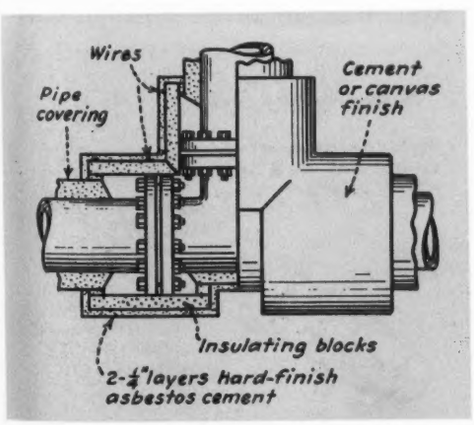
Widely used heat-insulating materials for plant piping include "85% magnesia", laminated asbestos-felt, and various forms of mineral wool (both molded and felted), including glass wool. The magnesia covering is molded in sections or blocks and contains about 85% basic carbonate of magnesia with 10 to 15% of long-fibre asbestos as a binder. Both magnesia and laminated asbestos coverings may be used safely up to 600 F. Mineral-wool insulation can withstand temperatures higher than 1000 F.

For pipes above the temperature limit of magnesia and asbestos, double-layer insulation is common. An outer layer of 85% magnesia or asbestos is protected from overheating by an inner layer of molded covering composed of calcined diatomaceous silica, asbestos fibre and cementing materials. This high-temperature covering

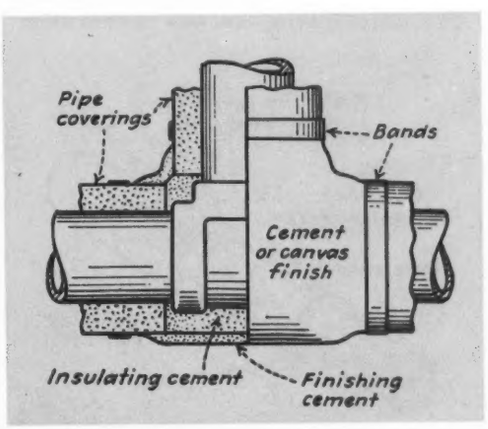
RECOMMENDED THICKNESSES OF 85% MAGNESIA
(plus inner layer of H.T. for high temperature)

Note: HT = high-temperature covering, S = standard thick, DS = double standard

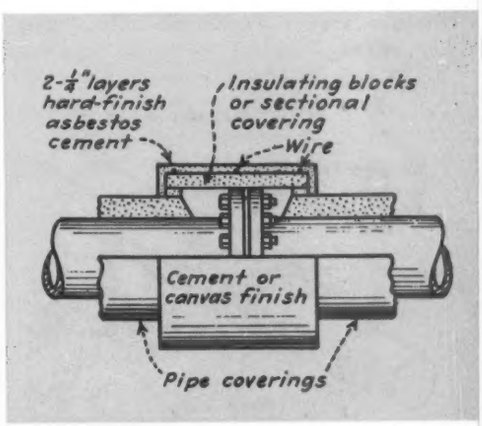
	Temperature of Hot Surface — F															
Pipe Size	170	270	370	470	570	670		770		870		970		1070		
	Temperature Difference — F															
Inches	100	200	300	400	500	600		700		800		900		1000		
	85% Magnesia					HT	Mag	HT	Mag	HT	Mag	HT	Mag	HT	Mag	
1	S	S	1½	2	2	2		2		2		2½		2½		
2	S	S	1½	2	2	1½	1½	1½	2	2	2	2½	2	2½	2½	
3	S	S	1½	2	2	1½	1½	1½	2	2	2	2½	2	2½	2½	
4	S	S	1½	2	2	1½	1½	1½	2	2	2	2½	2	2½	2½	
5	S	S	2	DS	DS	1½	2	1½	2	2	2	2½	2	2½	2½	
6	S	S	2	DS	DS	1½	2	1½	2	2	2	2½	2	2½	2½	
8	S	S	2	DS	DS	1½	2	2	2	2	2	2½	2½	3	2	
10	S	S	2	DS	DS	1½	2	2	2	2	2	2½	2½	3	2	
12	S	S	2	DS	DS	1½	2	2	2	2	2	2½	2½	3	2	
14	S	S	2	DS	DS	1½	2	2	2	2	2	2½	2½	3	2	
16	S	S	2	DS	DS	1½	2	2	2	2	2	2½	2½	3	2	
18	S	S	2	DS	DS	1½	2	2	2	2	2	2½	2½	3	2	
20	S	S	2	DS	DS	1½	2	2	2	2	2	2½	2½	3	2	
Flat	1½	1½	2	2½	3	1½	2	2	2	2	2	2½	2½	3	2	



This fitting cover is made from molded block, insulating cement



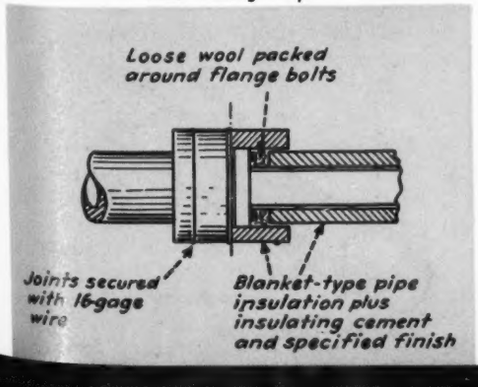
This insulating-cement cover is suitable for small pipe fittings



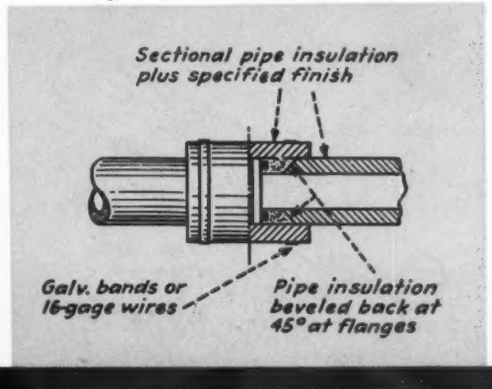
Removable flange covers make it convenient to break pipe joints

HOW TO INSULATE FLANGES AND FITTINGS

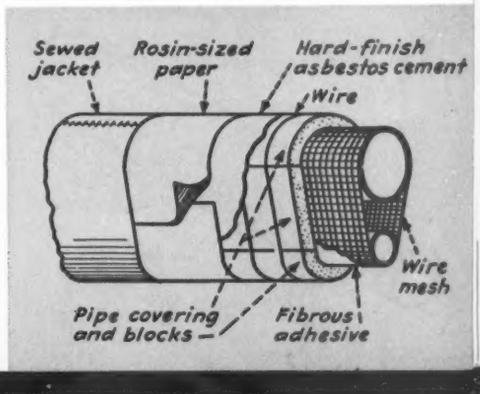
Blanket-type mineral wool forms this flanged-joint insulation


Loose wool packed around flange bolts
Joints secured with 16-gage wire
Blanket-type pipe insulation plus insulating cement and specified finish

Mineral-wool sectional covering insulates this flanged joint


Sectional pipe insulation plus specified finish
Galv. bands or 16-gage wires
Pipe insulation beveled back at 45° at flanges

Covering parallel pipes in this fashion "shares the warmth"



looks like magnesia, has lower insulating efficiency and ability to resist temperatures well above 1000 F.

Both mineral wool and laminated asbestos are particularly suited for points subjected to heavy vibration or shock. The accompanying tables give insulation thickness as commonly recommended for laminated asbestos and magnesia coverings. Note that the correct thickness increases with both pipe size and temperature.

Sketches show standard methods of covering piping and fittings. Such applications are fairly simple for any man with mechanical sense and a little practice. Magnesia and other molded coverings can be easily sawed to trim length and bevelled with a knife at the ends that face the flanges.

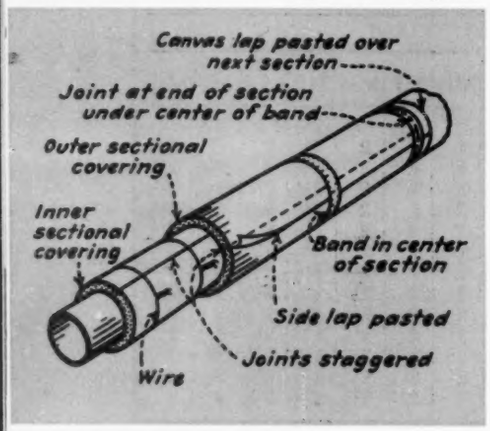
Coverings on bends, fittings and other irregular surfaces can be built up by wiring on odds and ends of broken magnesia blocks or pipe coverings and filling the remaining spaces with magnesia cement. Since this cement is of exactly the same composition as the solid pieces the mass sets as a homogenous whole.

Apply 85% magnesia cement in thin layers, letting each dry before applying the next. If the surface is smooth, wire mesh may be needed to hold the cement in place. In general it is difficult to make magnesia cement or ordinary asbestos cements stick directly to metal surfaces (particularly hot metal surfaces) without wire reinforcements.

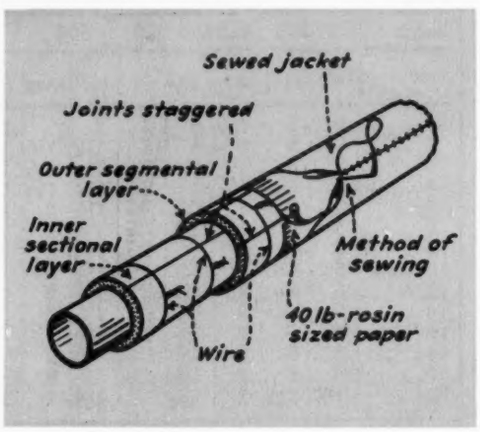
For quick insulation of flanges and fittings, by direct application of insulation to the metal without reinforcement, use a cement specially compounded for high adhesive capacity. First dab or throw it on in spots. When these dry they will help anchor the

FOLLOW THESE APPLICATION STANDARDS FOR PIPE COVERING

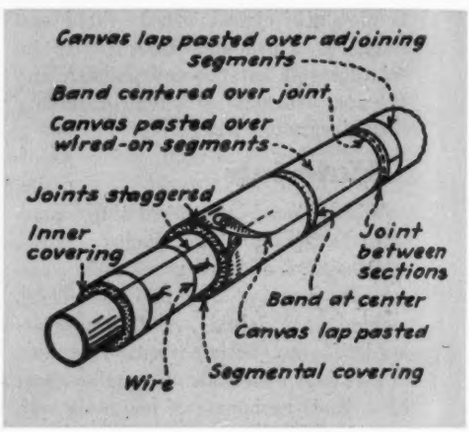
Molded sectional covering in two layers


Canvas lap pasted over next section
Joint at end of section under center of band
Outer sectional covering
Inner sectional covering
Band in center of section
Side lap pasted
Joints staggered
Wire

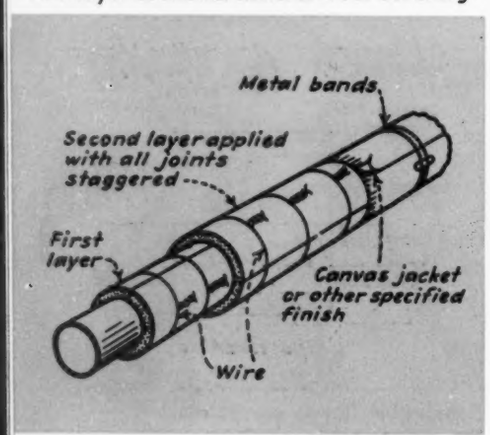
Second layer segmental with sewed jacket



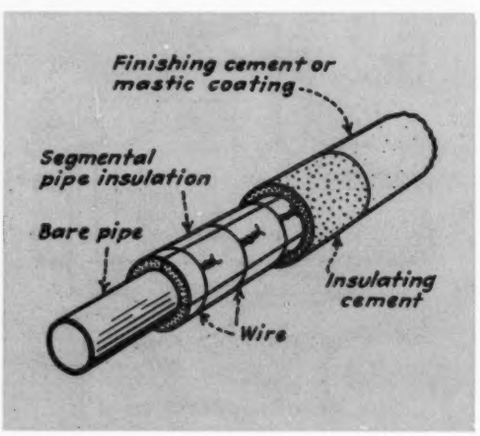
Second layer segmental with banded jacket



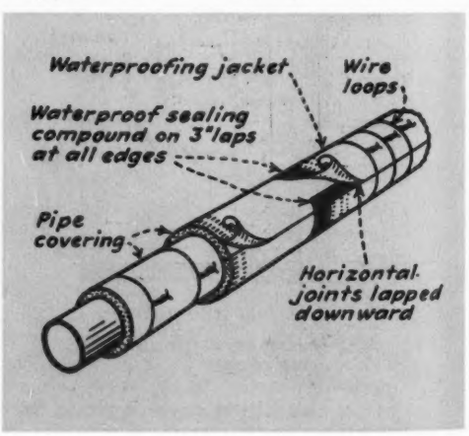
Two-layer sectional mineral-wool covering



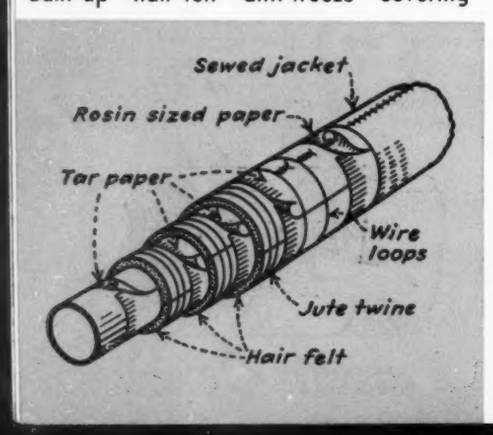
Segmental mineral wool with cement finish



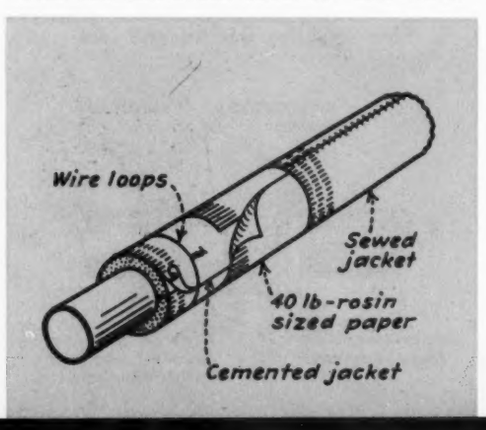
Application of weatherproof jacketing



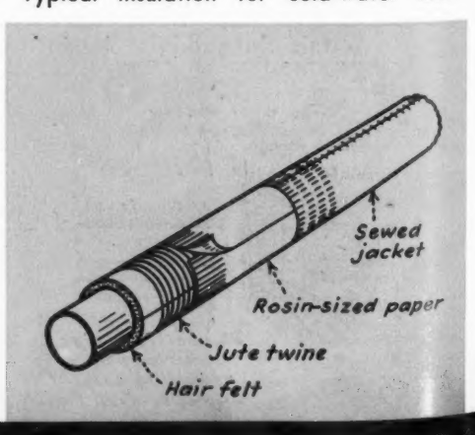
Built-up hair-felt anti-freeze covering



Hair-felt anti-sweat cover for cold water



Typical insulation for cold-water lines



next layer. This, in turn, should not be applied too thick.

Asbestos and mineral-wool cements are available in a great variety of types and prices. In general, the cements of highest insulating value will tend to be light, soft and difficult to apply, while the harder and stronger cements will have low insulating value. That is why the use of so-called hard-finish cements is largely confined to finish coating for hardness and good appearance. In general, insulation on fittings, bends, etc, is finished with either canvas or hard-finish cement.

Insulation for cold lines may range all the way from a simple anti-sweat jacket for cold water to elaborate built-up thick insulation for low-temperature refrigerating lines. Materials used include hair felt, cork and mineral-wool felt. An essential characteristic of low-temperature insulation is complete sealing against the penetration of moisture that would otherwise destroy the insulation. Check periodically to make certain that such coverings remain hermetically sealed and completely free of internal water or ice.

The application of refrigeration insulation is a specialty for experts.

Maintenance

Routine maintenance of warm-pipe insulation should include prompt repair of damaged surfaces, repainting and waterproofing, tightening bands and wires, repairing torn canvas jackets. Look out for shrinkage, loosening, and the effect of moisture, fumes and vibration. Make sure that steam temperatures have not been raised above the safe limit for the material used. Check carefully for steam and water leaks concealed by insulation.

Often a casual inspection will reveal bare flanges—either originally bare or left so by a recent replacement of the gasket. A single large bare flange can waste a ton of coal per year, so all such should be covered—preferably with replaceable covers.

Flanges

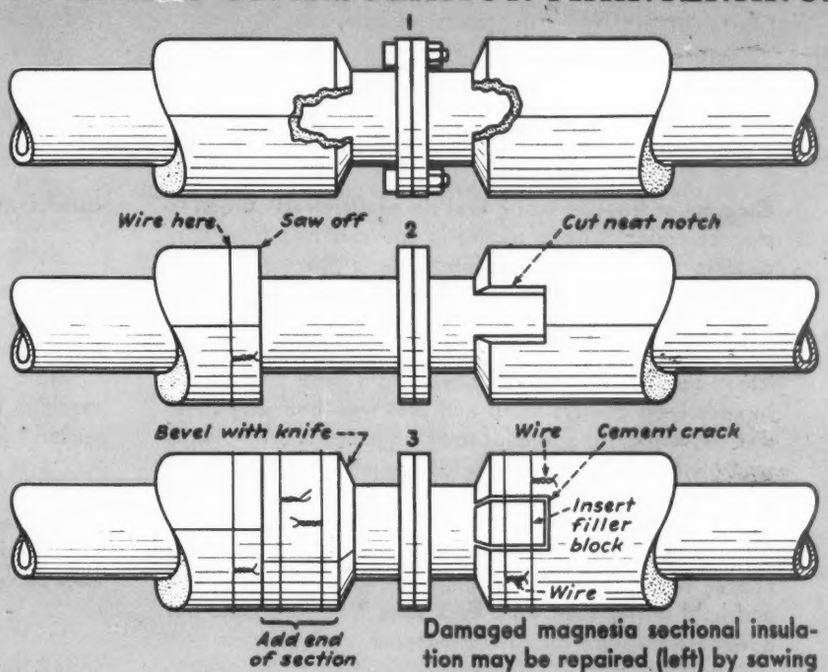
The preservation of flange covering is a major maintenance problem. Even supposedly removable covers are often broken in removal, particularly when an emergency requires quick access to the flange. Replacement of the insulation is a nuisance, too often delayed or omitted because the plant can run without it. It should be a standard rule to protect flange covers as far as possible and replace them promptly.

Silicate of soda (water glass) is a convenient and powerful adhesive for cementing tears in asbestos laminations or canvas jackets. Where magnesia covering is broken, a monolithic repair can be made by wiring in a magnesia "Dutchman" (see sketch) and filling voids with magnesia cement, which has the same composition as the block.

RECOMMENDED THICKNESSES OF LAMINATED ASBESTOS PIPE COVERING

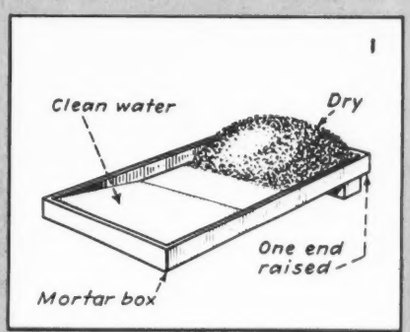
Temperature of Heated Surface, F	Pipe Size		
	Under 2 in.	2 to 4 in.	4½ in. and up
Up to 300	1 in.	1½ in.	1½ in.
301 to 400	1½ in.	1½ in.	2 in.
401 to 500	2 in.	2 in.	2½ in.
501 to 600	2 in.	2½ in.	3 in.

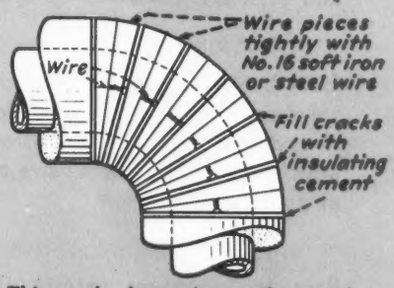
POINTERS ON INSULATION MAINTENANCE



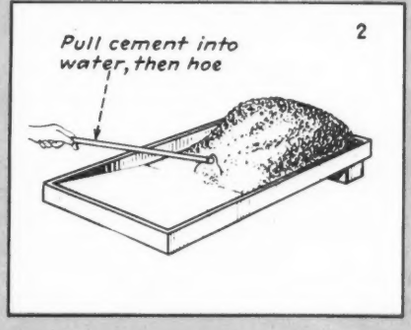
Damaged magnesia sectional insulation may be repaired (left) by sawing off bad end and wiring on a new piece, or by (right) wiring in a "Dutchman" and sealing it in with insulating cement. Restore canvas after repair.

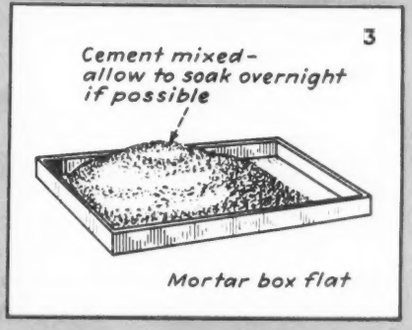
Three steps in mixing glass-fiber insulating cement. Use 18 gal water to a 50-lb bag of insulating cement





This method may be used to insulate a smooth bend or a welding elbow





POINTS TO REMEMBER

Cure major troubles first * Get rid of dissolved oxygen to stop corrosion * Keep piping in line and free from condensate pockets * Best maintenance is preventive; start with complete, correct drawings of the piping system

Threads

Clean-cut threads insure long-lived tight joints * For good threads keep chasers sharp and dies free from chips and dirt * Avoid cutting threads too long or too short * Simple emergency repair methods fix leaking joints

Flanges

Align flanges before bolting * Tighten bolts evenly, in proper sequence * In general, narrow, thin gaskets seal and hold better than wide thick ones * Be sure bolts put adequate pressure on gasket material

Welding

Properly made welded joints should need no maintenance * Use welding as a handy tool for patching, construction, and general maintenance all around the plant

Valve Selection

Give the valve a chance—select it for the job * Choose valve size to match flow, not pipe size * Remember pressure, temperature, nature of service and kind of fluid affect selection * Be sure valve construction fits conditions at point of installation

Valve Installation

Easy access insures correct operation, maintenance * Don't position valves so bonnet forms a dirt pocket * Workman-like installation practices prevent valve damage * For accurate long-life regulating-valve service, pay careful attention to piping details, installation methods

Valve Repair

Inspect valves regularly to catch troubles early * Keep valves clean, lubricated and properly packed * Simple repairs, when needed, reclaim valves for further service * Most valve repairs require only common hand or machine tools; home-made jigs and fixtures make the job easier * Experience at one plant shows repair pays

Hard-Facing

Good hard-facing depends on proper surface preparation, preheating, correct flame, careful application and slow cooling * Hardened surfaces resist severe erosion

Traps

Install traps to avoid steam binding and short circuiting; uniform connections facilitate replacement * Keep traps clean, seats tight and linkage free from lost motion * Test traps by temperature, by sound, by viewing discharge or by more positive discharge-measurement method

Supports

Make sure that anchors hold and expansion joints slide freely * Too-wide hanger spacing may cause pipe sagging so that condensate collects and causes water hammer * Check to see that hangers share piping load equally * Allow for expansion movement and forces

Insulation

Good insulation, well applied and of economic thickness, pays big dividends * Keep flanges well covered * Follow standard specifications when installing or replacing insulation * Keep insulation in good condition

ACKNOWLEDGMENTS

In preparing this Handbook, POWER has had sincerely appreciated assistance from sources too numerous to mention individually. In particular, the editors wish to acknowledge their great indebtedness to the leading manufacturers of piping and related equipment, whose helpful comments and published literature, both text and illustration, form the basis of much of this presentation. POWER's editors wish also to thank J R Carringer, W W Gamble and R S Hoffman, Standard Oil Co of New Jersey, and W N Scammon, Metropolitan Life Insurance Co, for their personal cooperation

Electronics—Secret Weapon of War

Presager of a New Scientific and Industrial Era

THE END of World War I left scientists with a new plaything. They did not know it at the time but they had their hands on a revolution. Within two years the world had radio broadcasting. Within ten years the whole art of motion pictures had been transformed as talking pictures replaced silent movies. Within twenty years television was born and people were seeing pictures in motion by radio.

The fulcrum of this revolution is the electron tube, a new tool of illimitable possibilities. One form of the electron tube is the familiar radio tube; the much publicized electric eye is another. There are many other forms, each having distinct capacities for saving time, saving energy, saving money, protecting life, limb and property.

The electron tube puts the electron to work—and the electron is the basic building-block of the universe.

Electronics is the new art, the new science of putting the electron to work. Radio and sound pictures and television are aspects of electronics; but there are many other facets of this revolution which have been brewing since the last war.

The electron tube has a typical American family tree. Edison made the basic discovery of the "Edison effect" some sixty years ago. This was followed by the invention of the "Fleming valve" and the "de Forest grid". Then Armstrong contributed his share, and hundreds of engineers in garret and cellar workshops and in the great university and industrial laboratories went to work on the tubes which employ electrons. The tube was a plaything before the last war but the world conflict brought it out of the toy stage and made it a practical, powerful tool.

Today the electron tube is guiding the destinies of the greatest armies and fleets ever engaged in the history of the world.

It is a part of the nerve center of the battleship, directing its course, finding its adversaries, broadcasting running accounts of air battles to its crews, directing gun fire and determining ocean depth.

In the air it is the means of locating and identifying enemy planes, piloting planes automatically, giving communication from plane to plane and to shore. It is even operating the controls of the plane.

In the maneuvering tank, in the officer's car, on the back of a foot soldier it transmits and receives vocal messages from every unit of the fighting forces.

Along our borders, and those of our Allies is an electronic screen which counts, follows and identifies enemy planes a hundred miles away through darkness and through fog.

In industrial plants there are electronic counters that enumerate passing articles faster than the eye can see; automatic sorters which discard defective, oversize, undersize, off-color articles; automatic cutters; devices which inspect the inside of things which the eye cannot see; controls which protect workers; controls of temperature; smoke eliminators; intruder alarms; automatic controls for whole batteries of machines.

In its October progress report on American industry, the War Production Board points out that the radio business is *five* times greater than a year ago. From 20 million dollars a month last fall, it has increased to well over 100 million dollars a month. Unfilled war orders are in excess of 4 billion dollars.

From such vast growth will emerge a new engineering of products which will immeasurably improve our peace-time living.

After the war broadcasting will be infinitely more satisfactory: radio receivers will perform with a new fidelity which will amaze us. Television reception will be as flawless as the motion picture. Present secret war developments will readily be convertible to peace-time devices that will improve our standard of living.

No longer will ships collide with other ships, with icebergs or the shore. No longer will trains collide and aircraft crash in flight.

Garage doors will open as we approach and automatically close themselves. Electric lights will automatically go on and off according to our wants and needs. Furnaces and boilers will be controlled and smokestacks will cease to belch wasteful smoke. Air will be made dust free and germ free. Food contamination will be checked, meat made tender.

Grade crossings will be made safe and auto traffic will be automatically controlled.

Medical science sees new wonders ahead. Already it is possible to see "whiskers" on germs, germs which heretofore had been but a blur when viewed through the strongest optical equipment available.

Today so much secret development is going on in the ultra-high-frequency field that little can be said of its great future. But, without divulging military secrets, it can be said that ply-wood is being dried electronically in minutes instead of hours. Ultra-high-frequency welding (not to be confused with flame welding controlled electronically) is being done dramatically and efficiently.

Ultra-high-frequency heating promises to revolutionize the baking industry—it may even heat our homes.

What is this miracle working tube that can see, hear, taste, feel and smell a thousand times more sensitively than was possible heretofore?

What is the electron? No one knows, not even the scientists who know how to employ it. Electrons cannot be seen or felt; but if 6¼ million million million electrons are pushed through a 100-watt electric lamp per second, it will light up to full brilliance. For electric current merely is a mass movement of electrons. Each electron carries its share of electricity, and since the electron has so little weight it can be moved easily and quickly. Therefore, electricity transported by electrons can be turned on or off with great ease and speed. The electron tube merely is a device that controls the flow of electricity. It is an amplifier of power which can be made to do wondrous things. The sound of a termite gnawing inside of a log can be amplified a million times . . . to a roar that can be heard over great distances.

Colors can be classified and matched to a degree not possible by any other means.

Chemical or vitamin consistency can be recognized by counting radio activity within the subject being analyzed.

There is no industry in which electronic circuits cannot be used to speed up production, to increase accuracy, to do heretofore impossible tasks of calibration and measuring.

The opportunities afforded the engineers who are developing this new "electronic age" are limitless.

* * * *

Today the electronic industry is 100% at war. It is meeting the exacting demands made upon it.

Never before was electronic equipment called upon to withstand temperatures ranging from 75 degrees below to 150 degrees above zero Fahrenheit. Never before did radios and transmitters have to withstand the shaking and abuse to which they are being subjected today.

War demands have called for much redesign, much change of materials and a new conception of operating to tolerances never dreamed of in peace-time material. As a result, electronic parts and equipment makers are building better devices.

Universities and colleges are working at top speed to produce electronic engineers, for every radio operator in a plane, every radio man in the ground forces and on ships, every man operating radar equipment or electronic control devices in ordnance . . . and there are many thousands of them . . . must be a trained technician.

The wall of military censorship is high but it is no secret that one of Britain's best weapons that keeps the Luftwaffe from exterminating London is a radio locator, a device that gives alarm of approaching planes long before they can be seen with telescopes. Scanning the horizon constantly the locator warns of the enemy's approach. In the nose of a night fighter, the locator informs pilot and gunner when the enemy is within range. Neither is it a military secret that gunfire can be controlled by electronics, and that electronics is having a big share in training our new armies.

Necessity draws a veil over the most dramatic uses of electronics in warfare, but among those who know there is nothing secret about the fact that many of today's wartime applications will revolutionize our peace-time lives. Electronics will invade every industry with totally new devices and machines. The future of the electronics industry is limited only by man's imagination.

Such is electronics, and its destiny!

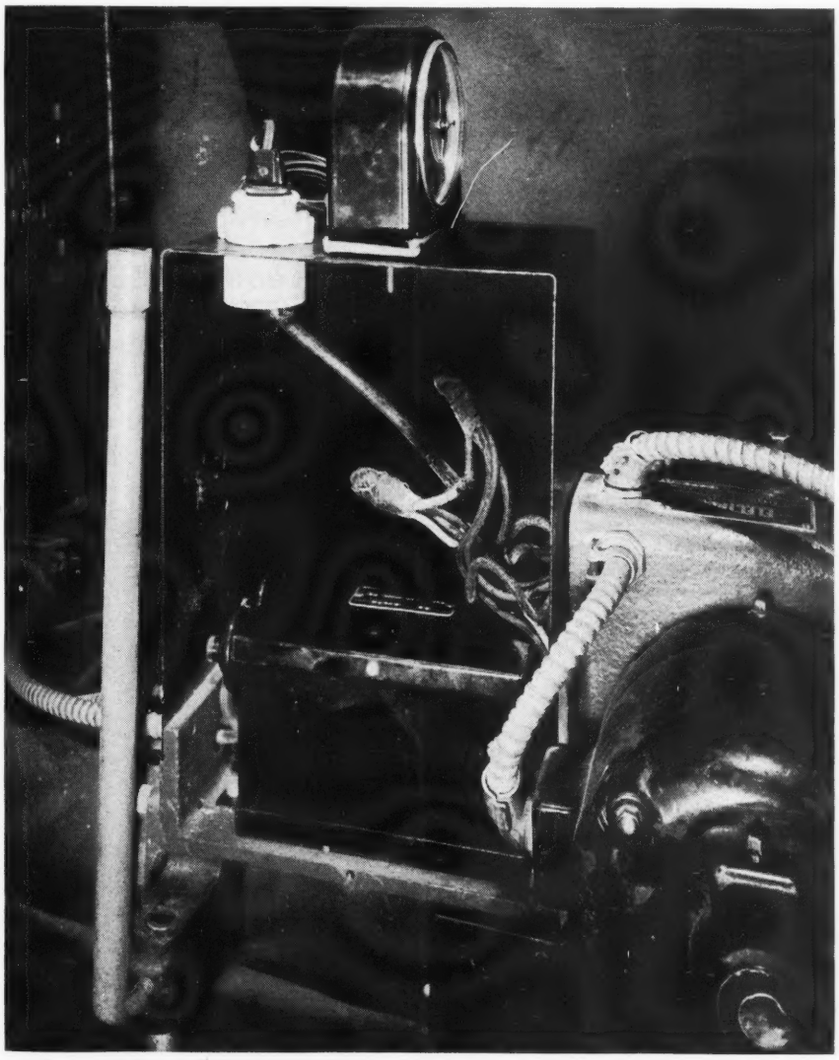
James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This is the sixth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates



Electric clock wired to motor leads totalizes time of oil-burner operation

Clock Meters Oil-Burner Operation

CONFRONTED with the heavy rationing of house-heating fuel-oil along the East Coast, one of the POWER editors has instituted some conservation measures in his own home. For one thing, he drilled the top of the oil-burner control box housing and installed an ordinary two-prong receptacle wired across the motor leads.

An ordinary self-starting electric clock stands in a pan on top of the box and plugs into the receptacle. Whenever the motor and burner are in operation the receptable is energized and the clock operates. Thus clock reading measures total time of burner operation.

The editor has ruled a log to record the daily clock readings and equivalent oil consumption. Daily consumptions thus figured will be totalized and compared with actual gaging of the 1000-gal storage tank.

The purpose of this rather elaborate setup is to detect over-consumption before the rationed oil supply for the period is endangered.

If one had been conveniently available, a so-called "hour meter" used in refrigerator testing, would have been more convenient than the electric clock since it has multiple dials like an ordinary kwhr meter, and carries totals for a long period. The clock, of course, must be read daily since the hands go round and round over the same face.

This time metering can be applied to small industrial and institutional installations of the on-and-off type. The clock can be precisely calibrated in gph by keeping comparative records of tank gaging and hours of operation over a period of several days.

Speaking of Scrap

IT WOULDN'T DO to appear unpatriotic, but here are a few pertinent questions for the power engineer to consider:

Did you, Mr Plant Engineer, donate all your old valves in the scrap drive without first making sure that you could get replacements for those already out of order or soon likely to be out of order in your lines? What about that feedwater line valve that has been dripping because of a warped bonnet? How about that little valve on the bleeder line that has the stem chewed off down to the packing unit because the wheel is missing making the operators use pliers?

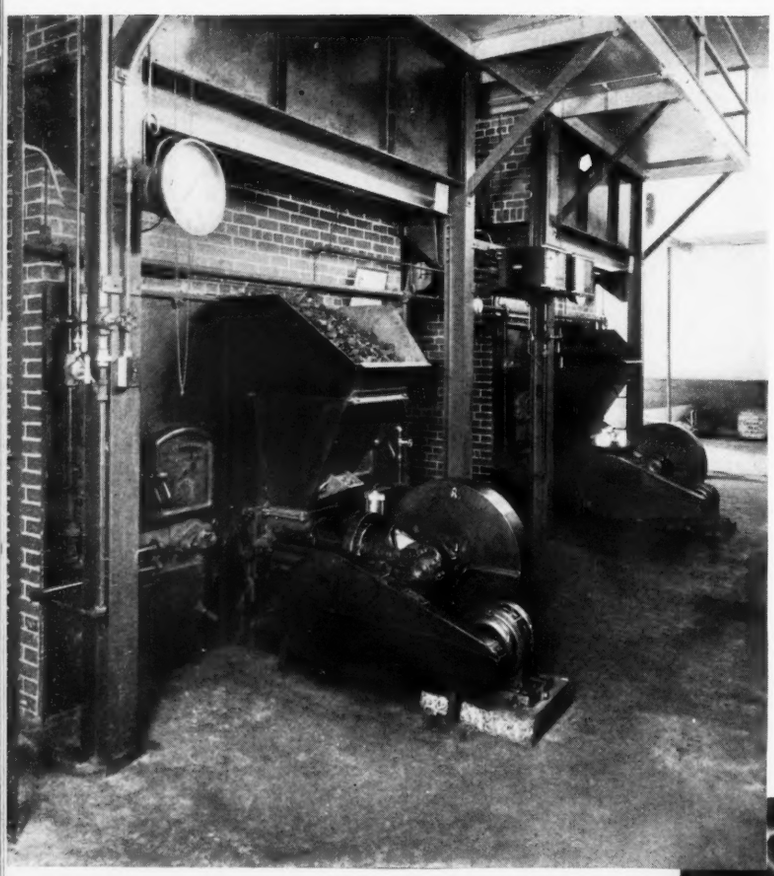
And what about that old throttle valve from which you intended to remove the seat to replace the badly eroded and corroded throttle-valve seat on your single-valve engine?

Did you dig through that pile of junk for a good bonnet for the first valve, a good stem for the second and a good seat for the third, knowing (as you do) that you have no replacements or you would already have made these changes? Or did you stick out your chest in manly pride at having contributed your bit, while the scrap collector hauled away the only replacements you had to keep a boiler or engine or pump on the line, and thereby keep the wheels of war industry rolling?

Certainly all scrap is needed. But donating a useful and needed piece of equipment to the scrap drive is like burning your house to keep warm. That kind of patriotism will put smiles instead of frowns on the faces of the officers of the German and Japanese high commands.

Menard, Ill. GEORGE HOLMAN

Riley Coal Burning Equipment fo

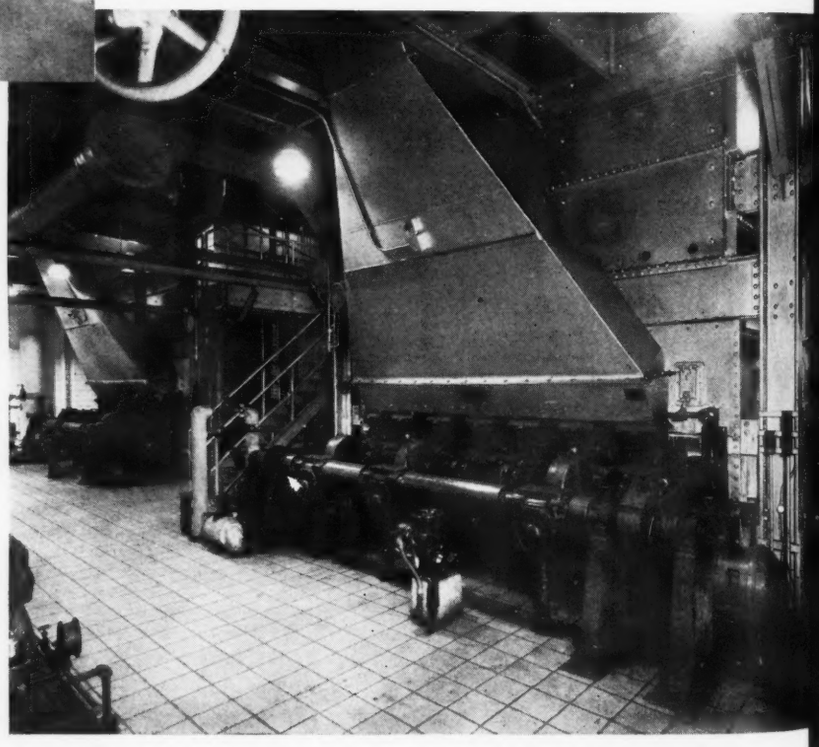


As manufacturers of practically all types of coal burning equipment, the Riley Stoker Corporation is in a position to be of service to you if you find it desirable or necessary to change from oil to coal firing.

Riley-Jones Side-Dump Stokers for boilers from 40 H. P. to 600 H. P.

Because Riley-Jones Side-Dump Stokers are adaptable to practically any boiler setting with but minor changes and because no basement is required for their installation, Riley-Jones Side-Dump Stokers have been selected by many plants when changing from oil to coal.

Riley-Jones Side-Dump Stokers are manufactured with either stationary or moving grates and with mechanically, hydraulically or steam driven coal feeding rams. The Riley-Jones is the original underfeed stoker—the daddy of them all. Constant improvement has kept it at the head of the list. Thousands of the country's leading companies use them.



Riley Multiple-Retort Underfeed Stokers for boilers from 250 H. P. up

For larger boilers, where basements or other means are available for ash disposal, Riley Multiple Retort Underfeed Stokers can be installed. Riley Stokers can be furnished either with continuous rocker dump or with single or double roll clinker grinder. You will find Riley Stokers installed in many of the leading central station and industrial plants.

RILEY

STOKER CORPORATION, WORCESTER, MASS

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

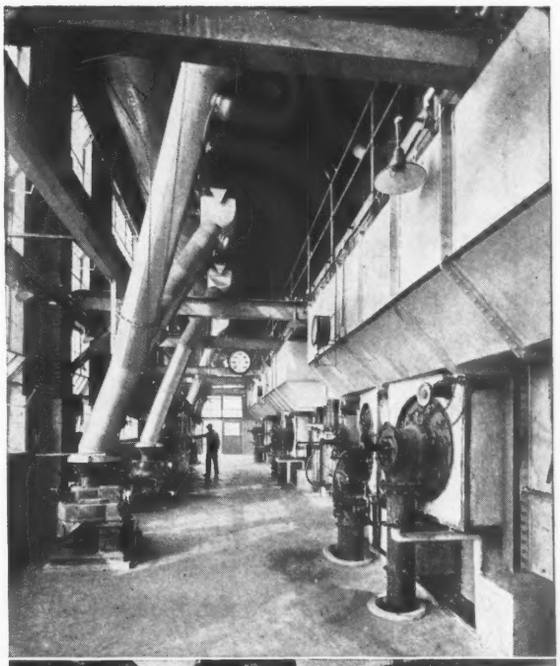
It will pay you to visit modern Riley Installation

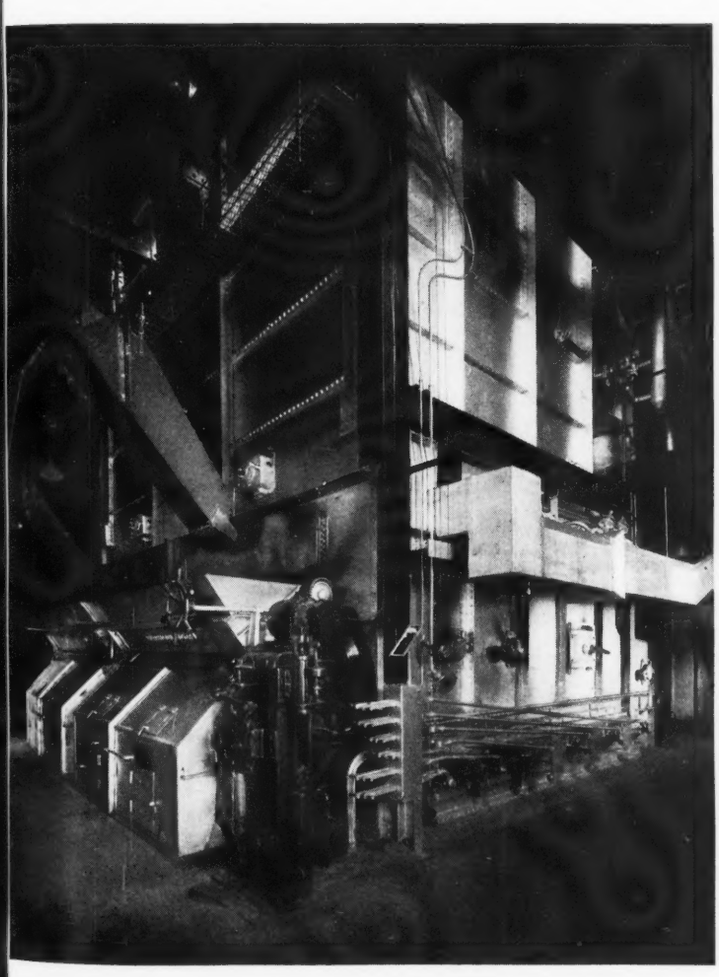
for your shift from oil to coal

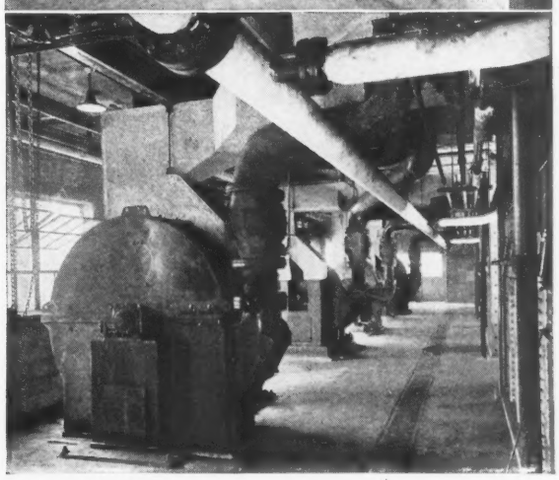
Riley Pulverized Fuel Equipment for boilers from 100 H. P. to the largest

When conditions make it desirable to use pulverized coal, Riley Pulverizers, because of their compact size and quiet vibrationless operation, can be installed with a minimum of difficulty. Oil fired units ordinarily operate at higher heat releases so that in some cases, when changing to pulverized coal, the furnace volume must be increased or the unit operated at lower rates.

If pulverized coal equipment is installed, the unit in the future will be capable of burning either oil or coal, depending upon the relative prices of the fuels. Riley Pulverizers are made in capacities from 1,000 to 35,000 pounds of coal per hour.







Riley Harrington Traveling Grate Stokers for boilers from 150 H. P. up

When anthracite can be burned instead of oil, then the Riley-Harrington Traveling Grate Stoker can be installed. Due to the fact that arches are required for proper combustion of anthracite coal on traveling grate stokers, changes in the setting are more extensive than when bituminous coal can be burned. The Riley-Harrington Stoker also efficiently burns coke breeze, lignite and the lower grades of bituminous coals.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

Automobile Ignition Parts Revamped for Gas Powered Compressor

By W W McCLOW, *Whiting, Ind.*

THIS REPORT shows how the ignition system of an industrial gas engine was completely revamped at little expense and with no use of priority equipment. Most of the job was improvised from automobile ignition parts. The machine in question is an 18½-in. by 20-in. horizontal double-acting 4-cycle twin-cylinder gas engine direct-connected to two compressor cylinders for 2-stage air compression. Fig. 1 shows cylinder arrangement.

The original high-tension magneto equipment on this machine had always been more or less unsatisfactory because: (1) Moisture fouled the high-tension system of magneto, particularly in humid weather and with intermittent operation, (2) engine often failed to start immediately when needed —a trouble generally traceable to No. 1, (3) weak sparks caused missing and power loss. Engine tended to stall when load was suddenly increased, (4) sparks grew weaker with continued operation of magneto (probably caused by accumulation of carbon and dirt and by the heating of high tension equipment near engine cylinders), and (5) grounds and capacity effect in long secondary cables weakened the sparks.

Selects Low-Tension System

For these reasons, and because high-tension magneto repair parts were hard to find, the engineers selected a low-tension ignition system with all circuits operating at low voltage, except a coil and short secondary lead at each spark plug. The desired arrangement provided a separate low-tension circuit for each plug.

While large engines sometimes have two separately energized plugs to a cylinder, one was considered enough in this case. Because of wartime conditions, priorities, etc, we made no attempt to purchase a ready-made low-tension ignition system either of the battery or the magneto type. On the other hand, selection of automotive equipment insured spare parts.

As sketched in Fig. 1, the system selected consists primarily of a heavy-duty automotive storage battery, a Tungar charger, four heavy-duty coils (one for each plug), two twin breaker assemblies, an overspeed safety switch, and necessary wiring and connections.

In general, a battery with heavy plates, and few of them, is recommended for this type of service where ignition represents the only load. A six-volt 57-plate heavy-duty automotive battery has been in service for several months on this job. Although this gives good results, it will soon be replaced by one of four 6-volt, 45-plate automotive-type industrial batteries bought to take care of the entire ignition conversion program in this plant. A 5-amp Tungar unit charges the battery continuously, with a rheostat and ammeter in circuit.

As shown in Fig. 1, this installation uses four 6-volt heavy-duty coils. Standard automotive coils would probably have served, although with a shorter life. To minimize high-tension circuits, we mounted one coil alongside each plug with only 8 to 10 in. of wire connecting the two.

The two breaker assemblies required for this installation we bought from a dealer in used automobile parts. Each assembly contains two breakers, 180 deg apart, making a total of four breakers in the two assemblies, or one for each plug. The following alterations were required:

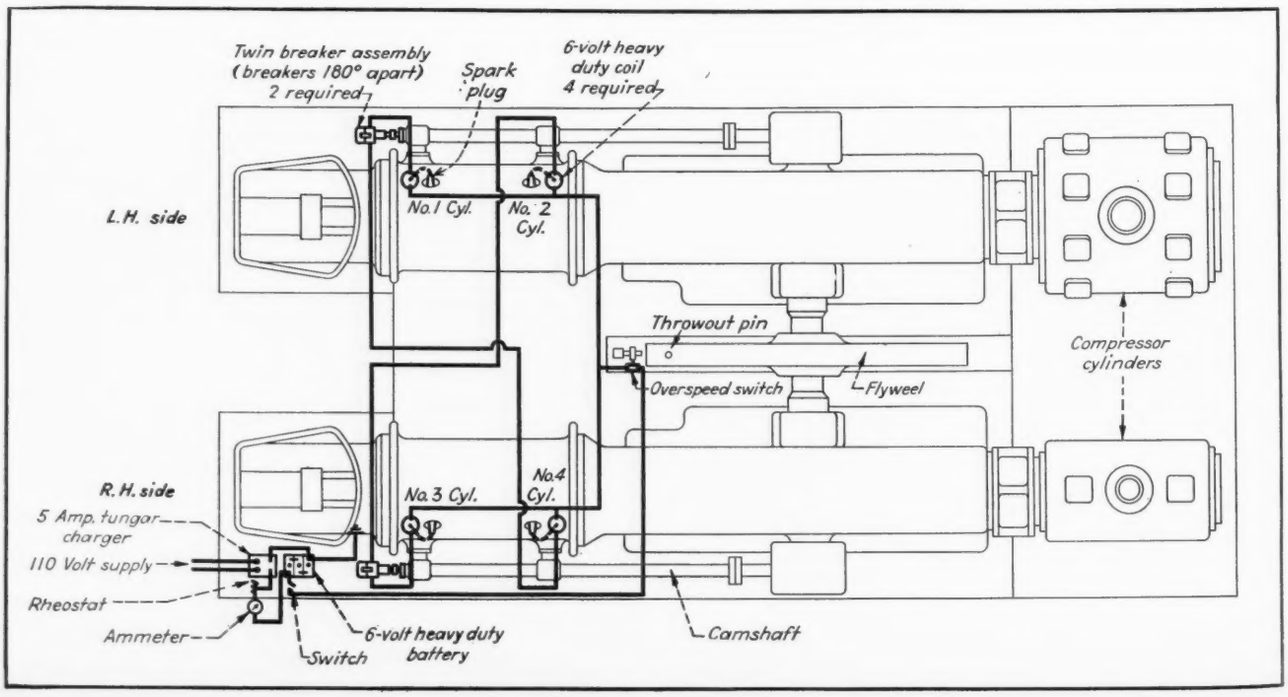
The automatic advancing mechanism in the body of each assembly was replaced by a straight shaft made of self-hardening tool steel. The conductor connecting the two insulated breaker points was removed. One of the insulated points was left connected with the original terminal post and condenser, while the other point was connected to a new post and condenser.

In Fig. 2 and 4 (page 101) note that each hold-down plate is equipped with slotted holes and spark-advance lever. Each breaker assembly was mounted firmly on a steel bracket and driven from the end of a camshaft through a stub shaft and coupling (Fig. 2). All secondary cable projections on the breaker cap were cut off and the surface ground flat and smooth and painted.

The overspeed safety switch, formerly set to ground the magneto primary in the event of overspeeding, was revamped to reverse the operation, providing a closed circuit during normal operation and a broken one in case of overspeeding. This was accomplished by eliminating the old contact and mounting a tilting-type mercury switch on the shaft of the existing switch mechanism.

As shown in Fig. 1, the main supply low-tension circuit passes first through a safety switch so that overspeeding

Fig. 1—Ignition system—low-tension lines shown solid; high-tension dotted. Left-side breakers fire 1 and 4. Right side, 2 and 3



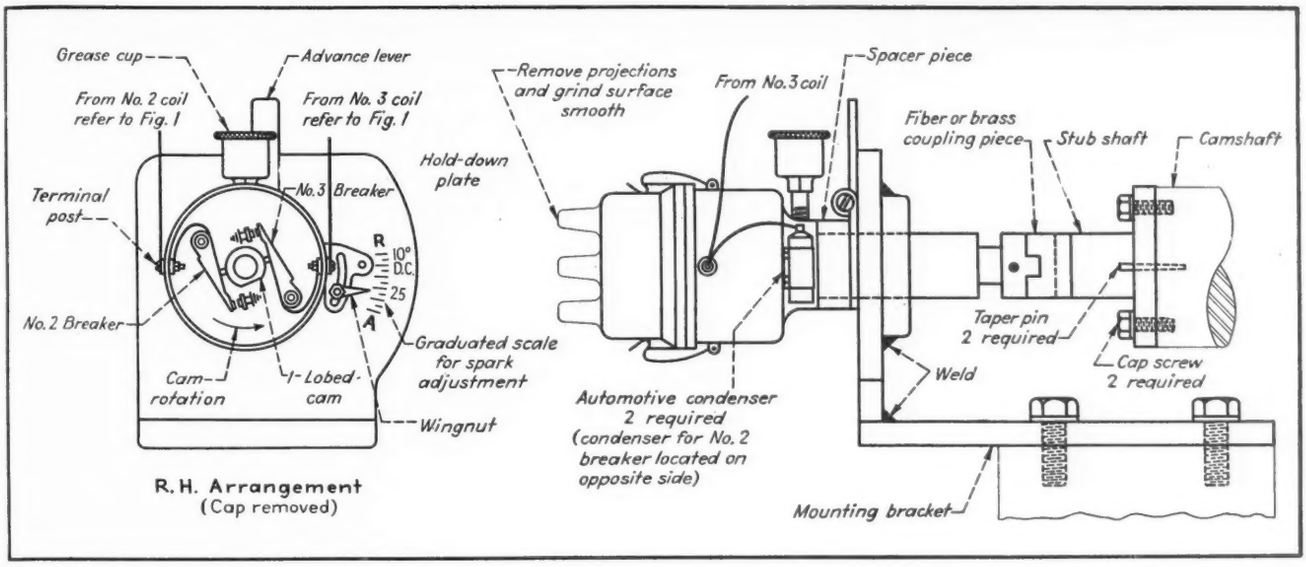


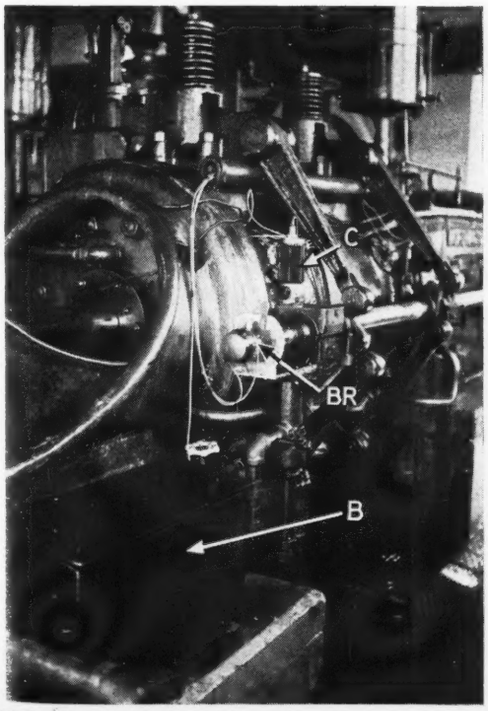
Fig. 2—Automobile breaker assembly adapted to this job by (1) replacing advancing mechanism by a straight shaft with a 1-lobe cam at end, (2) removing distributor rotor, (3) breaking the electrical tie between the two insulated breaker points, leaving one point connected to the original terminal post and condenser, and connecting the other to a new post and condenser, (4) equipping each hold-down plate with a slotted hole, an advance lever and a scale graduated in crankshaft degrees, (5) mounting each breaker assembly firmly on a bracket and driving from the end of the camshaft, (6) removing all the secondary-cable-receptacle projections from the breaker cap, grinding the surface smooth, painting

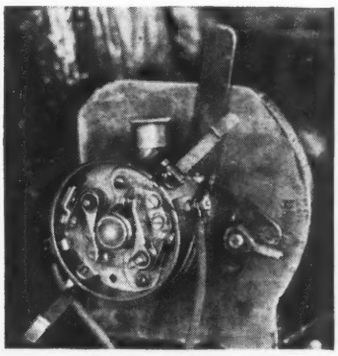
will cut out the entire ignition system. From here it goes through the primary windings in the various coils and thence to the ground as the corresponding breaker points are closed by their cams. When these points open and thus break the primary circuit, the plugs are fired by the secondary leads from the corresponding coils.

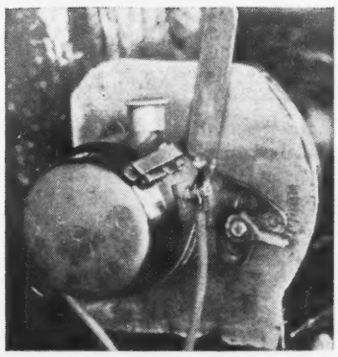
To understand the firing system, note again that the engine is a twin, 4-cycle, double-acting machine with cranks 180 deg apart. Each of the two cylinders fires on both sides of the piston so a complete cycle occurs every two revolutions of the crankshaft. Since there are four explosions in two revolutions, the firing points will be 180 deg apart measured on the crankshaft, or 90 deg measured on the cam shaft or breaker cam, which turns at half the crankshaft speed.

The firing order of this engine is 1243 (see Fig. 1, where each cylinder end is marked as a separate cylinder). The contacts in each breaker assembly are spaced 180 deg apart in terms of the camshaft. Thus, it is clear that one of the breakers must be used to operate spark plugs 1 and 4, and the other to operate No. 2 and 3. In Fig. 1 the left-side breaker assembly fires plugs 1 and 4, while the right-side assembly fires 2 and 3.

Fig. 3 (Left)—Right side of engine showing No. 3 coil (C) breaker assembly (BR) and box containing battery and charger (B). Fig. 4—(Right)—Breaker assembly shown with cover off (top) and cover on







Initial Adjustment

To time the engine it was barred over to the end of No. 1 compression stroke with the left-side breaker hold-down plate clamped in dead-center position and the stub shaft still disconnected from the camshaft, but engaged with the breaker shaft through the coupling. The breaker shaft was then turned by hand until No. 1 breaker just started to open. The stub shaft was marked in this position and the necessary holes drilled and tapped to connect it tightly to the camshaft.

After this connection had been completed final adjustments were made by loosening the clamp screw and shifting the breaker body in the hold-down plate. The right-side breaker assembly was similarly timed after barring the engine to the end of No. 2 compression stroke.

The engine starts immediately with this low-tension battery ignition system. It takes load rapidly without faltering or loss of speed, responds quickly to load increases, and carries full load with somewhat less throttle opening.

Missing has been eliminated. Moisture troubles are no longer experienced. The sparks delivered to the cylinders are now strong enough to allow several formerly discarded plugs to be used. Finally, the constant repairing of magnetos has become a thing of the past.

Diesel Makes Exhaust Gas—Turbine Supplies Kilowatts

Sulzer Brothers, Switzerland, report experience with supercharged 2-cycle oil engines and point to the gradual development of a prime mover in which the diesel cylinder work all goes into the supercharging compressor*

▶ INCREASING SUPERCHARGING PRESSURE calls for more of the engine output to drive the air compressor but also results in more available energy in the exhaust gas that can be recovered by gas-turbine wheels. If supercharging pressure is brought up to about 75 psi gage, all the work of the diesel cylinder is needed for air compression while the gas-turbine element can drive a generator or other power equipment.

The interesting possibilities of such a realignment of reciprocating and rotating elements has led to construction of engines for supercharging pressures up to 75 psi gage having cylinder mean effective pressures as high as 255 psi.

In early tests, an experimental engine supercharged to 15 psi gage operated at 170-psi mep with clear exhaust. Charging air from a compressed-air system was heated to the temperature that would have been supplied by a normal compressor. A throttling orifice simulated the effect of the exhaust-gas turbine. These tests demonstrated that it is practical to operate a diesel cylinder up to 75 psi supercharging pressure and 255 psi mep, provided the construction of the engine is suitably adapted in material and design to comply with the increased stresses.

Exhaust-Gas Turbine

At higher supercharging pressures, however, additional excess air has been intentionally introduced to limit cylinder working temperature. The excess air has the effect of reducing possible efficiency gains from greatly increased supercharging pressure but produces invisible exhaust gas quite satisfactory for a gas turbine.

Based on the experimental results, a 1370-hp 4-cylinder 750-rpm opposed-piston engine was constructed with an overhung exhaust-gas turbine geared to the crankshaft. Reciprocating compressors coupled to the crankshaft supply scavenging and charging air at 15 psi gage. This engine operates at 170 psi mep at full load with a fuel consumption of 0.35 lb per brake horsepower hour.

After 3000 hours of service in the Sulzer works, it can be reported that the newly designed elements of this engine can stand the required operating conditions. No trouble developed from the gearing between gas turbine and main shaft. Even during periods of severe cold the engine started easily and quickly.

High-pressure supercharging results in reduction of price, weight and space for a given output. A 7000-bhp stationary plant has been designed for installation in a building space of 60 x 35 x 16 ft. Two 2-cycle 1000-rpm opposed-piston engines drive a common generator; engines are supercharged to 37 psi gage. An axial compressor with wheels arranged in two stages for intercooling supplies scavenging air. This compressor is driven by an exhaust-gas turbine. Energy which the latter cannot supply, during starting and at low loads, comes from an electric motor connected to an auxiliary diesel set. The motor idles when the engines oper-

* Condensed from the *Sulzer Technical Review*.

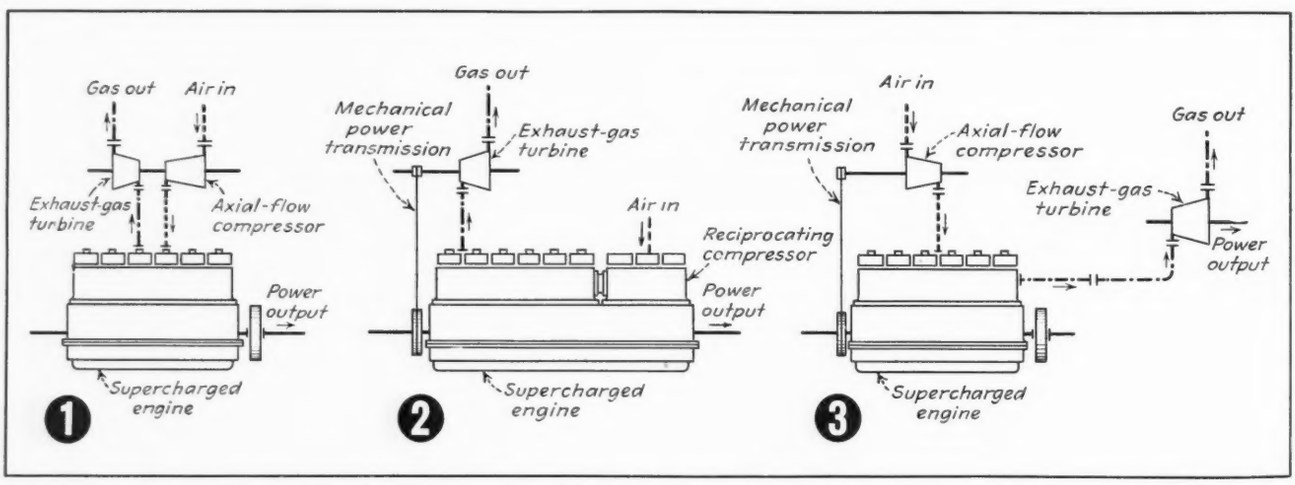


Fig. 1—Direct supercharging of 2-cycle diesel engines cannot be accomplished by the free-spinning gas-turbine axial-compressor unit because the air supplied is insufficient for starting and low loads. Fig. 2—High supercharging pressures can be obtained by a direct-coupled reciprocating compressor and mechanical transmission between exhaust-gas turbine and diesel engine. Fig. 3—Power-gas process with axial compressor geared to diesel-engine shaft and separate exhaust-gas turbine furnishing net output

ate under usual normal-load conditions.

Having demonstrated the practicability of operating a 2-cycle engine at high supercharging pressures and correspondingly high mean effective pressures, interesting future possibilities are indicated by the opportunity to utilize the entire output of the reciprocating unit for air compression and leave the exhaust-gas turbine free to drive a generator without mechanical interconnection between reciprocating and rotating parts.

When the power delivered by the diesel engine and that absorbed by the supercharging compressor balance each other, the effective output of the whole plant corresponds to the output of the gas turbine. The turbine may, therefore be uncoupled from the engine and compressor without disturbing the energy balance. The diesel-engine-compressor unit then serves to supply "power" gas in the same functionary manner as the steam boiler supplies its associated turbine.

Free-Piston Compressor

Two further byproducts of separating the engine and turbine shafts are (1) that several "power-gas generators" can supply a single gas turbine of relatively larger size, and (2) there is no longer need for employing a crankshaft on the diesel engine if free-piston compressors are used.

With opposed diesel pistons working directly on compressor pistons, as in Fig. 2, the pistons connect to each other merely by a linkage which ensures their running symmetrically. The essential feature of the construction is that power moves directly from the engine pistons to the compressor pistons without crankshaft and connecting-rod losses. Also, an automatic adjustment of the volume of the combustion space suits the supercharging pressure required.

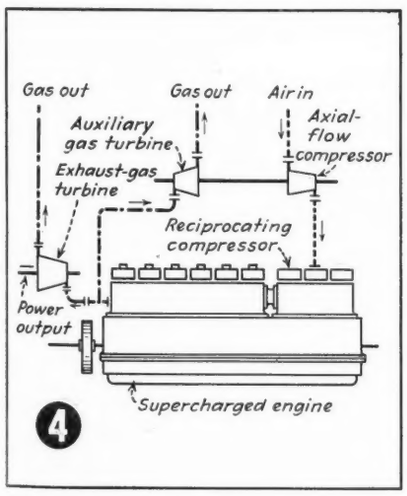


Fig. 4—Power-gas process with precompression for charging pressures above 75 psi gage where compressor power exceeds power developed by the engine

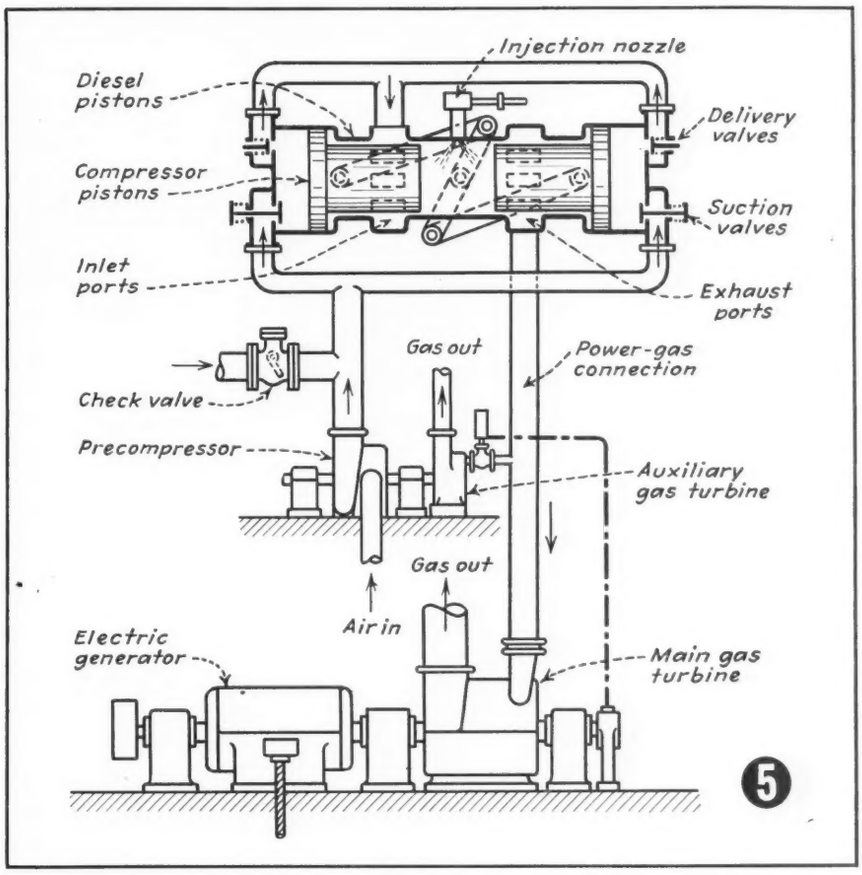


Fig. 5—Free-piston compressor supplies exhaust gas to drive main gas-turbine generating unit and auxiliary precompressor. All net power output comes from gas turbine set

This process represents the possible realization of a gas turbine with a thermal efficiency of 35-40%, without heat exchangers and requiring metals for turbine construction to stand only 840-935-F temperatures. The gas turbine can be of simple construction and needs no water supply, pumps or other usual auxiliary equipment. The turbine is also subjected to only moderate temperature and pressure gradients.

Large Power Output

With such an arrangement, great freedom of choice in layout of power plant naturally results because the gas generators can be distributed in any fashion near the turbine element rather than co-axially, as would be necessary with geared or other mechanical connections. Large power output can be obtained without large-bore diesel cylinders.

The process described, which might be considered a special case of 2-cycle diesel supercharging, can be carried out with crankshaft as well as free-piston compressors and both types have been thoroughly studied from theoretical and construction standpoints. Where diesel engine, compressor and exhaust-gas turbine are mechanically coupled, power for air compression is furnished automatically by either engine or turbine. If, however, the exhaust-gas turbine is not coupled to the diesel element, some power must be obtained from a special auxiliary compressor driven by the main gas turbine or an auxiliary unit as in Fig. 4.

The "power-gas" process combines the advantages of the constant-pressure gas turbine with the efficiency of the diesel engine. The constant-pressure gas turbine is limited in efficiency by working temperature of its metals. To keep temperatures within allowable limits, excess air must enter the combustion process. The diesel, however, can work on a considerably higher heat drop and can still claim the highest thermal efficiency of any prime mover.

✦ ✦ ✦

Correction

Rockville Centre's new 3000-hp diesel performs better than the curve (POWER, November, 1942, pg 65) indicates. The fuel-rate scale and curve should have been labeled lb/kwhr instead of lb/bhphr.

Putting the Air in "Air-Spun"

Compressed air finds a new use in preparing cosmetic powders and rouge. S M Dunham, Worthington Pump & Machinery Corp, in a prize-winning paper* describes methods used to overcome unusual requirements in the compressor installation

▶ IN 1935, ONE OF THE LEADING manufacturers of powders, perfumes, rouges, and pharmaceuticals decided to use compressed air to process dry ingredients. The degree of fineness (and consequent smoothness) to which they had been able to reduce the ingredients going into their powder and rouge, while as good as that obtained by any process then in use, did not entirely satisfy the manufacturers.

They therefore pioneered, supplementing the present mechanical methods, with air-actuated micronizers. This method required that accurately measured quantities of dry ingredients, and carefully metered volumes of compressed air at 95 psi be fed to micronizers, in which directional air nozzles created intensive and diverse swirls, causing the particles of mechanically processed materials to impinge against each other, and effect minute pulverization. It was believed a much finer and smoother product would be obtained, a belief which was amply borne out by later results and by the instant and continued acceptance of "Air-Spun" products.

Special Problems

The installation and operation of air-compressor equipment presented unusual problems. The air was to be used on the 9th and 10th floors of a light-manufacturing loft building where no vibration or objectional noise was permitted. Automatic control for fluctuating loads to produce air at constant temperature and nearly constant pressure was desired. The process required compressor capacity of 750 cfm to furnish oil- and moisture-free air at 95 psi.

After considering all possible locations the makers decided to install the compressors on the 10th floor. The weight of 2-stage units, which otherwise would have suited capacity needs and which would have been desirable from a capacity and power-consumption standpoint, precluded their use. Fear of future uncontrolled or excessive amounts of lubricating oil in the discharge air ruled out of consideration the light weight, multi-cylinder, high-speed compressor. A heavy-duty, low-speed, single-cylinder, single-stage, horizontal, double acting, conventional compressor was adopted. Three 12 x 11 machines, each rated at 95 psi, 250 cfm and 250 rpm, driven by 50-hp, 1200-rpm motors were installed.

Aluminum Pistons

To reduce the inertia of the reciprocating parts, and consequently the degree of unbalanced shaking forces, aluminum, rather than cast-iron, pistons were used. To adjust the center of gravity, in relation to the foundation, the motor over the compressor frame was placed nearer the crank end of the machine than usual.

While these steps lessened the degree of the unbalanced forces, it still did not isolate them from the building structure. A frame of 8-in. steel angles welded together formed a rectangle of the size required for the foundation. The horizontal faces of the angles, which extended inward toward the center, rested directly upon and were securely bolted to the floor. The enclosed area was then covered with a layer of 4-in.-thick formed cork. A ring of the same thickness carried upward inside the vertical faces of the angles extended for 3 in. beyond their top edge. The concrete poured on this bed of cork formed the foundation block weighing 10,000 lb. The result was an installation so free from vibration that it was passed without question by the inspectors of the building department of New York. To prevent the machines from operating in synchronism for any

* Submitted in the "Compressed Air in Industry" contest sponsored by the Compressed Air Institute.

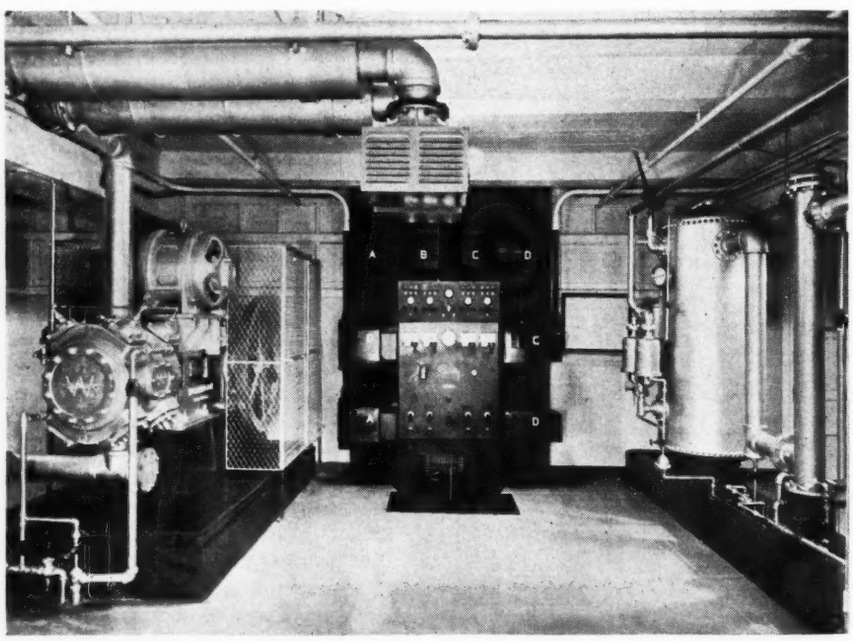


Fig. 1—Compact compressor control for all units mounted on one panel. Intake filters and silencers supported from ceiling permits free access to compressors

length of time sheave diameters were modified slightly, giving a compressor speed of 250 rpm for No. 1 unit, 245 rpm for No. 2 unit, and 240 rpm for No. 3 unit. Although two machines could at some time, be in step, synchronism would be instantaneous only. Adjacent compressors on the same center line were installed opposed, as a further compensation for unbalance.

Compressor control centers on the panel shown in Fig. 1. Provision was made, and all panel instruments mounted, for a total of four compressors even though only three have been installed at present. Control equipment includes four transfer switches, a 4-position drum selector switch, auxiliary relays, four Mercoid pressure switches, a timing relay, four reset pushbuttons, and a pressure gage.

The transfer switches allow any unit to be operated on bypass (hand position), start and stop (automatic position), or to be shut down (off position), without affecting or interfering with operation of the other units.

The drum selector switch between the pressure switches and the auto-transformer magnetic motor starters permits a change in sequence of compressor operation, so that use and wear of all machines will be equal.

Step Control

The sensitive Mercoid pressure switches, actuated by air-receiver pressure, are set for slightly different pressures so only those compressors required to meet air demands will operate. No. 1 pressure switch opens at 100 and closes at 95 psi; No. 2 pressure switch opens at 99 and closes at 94 psi; No. 3 pressure switch opens at 98 and closes at 93 psi; and No. 4 pressure switch opens at 97 and closes at 92 psi.

The timing relay, actuated by a small sub-sychronous motor, provides a delay between the energizing of any two motor starters, preventing second motor from starting until the first is running with the compressor fully loaded.

The four reset pushbuttons serve as cutout switches during weekend and shut-down periods. Also, they prevent the automatic restarting of any unit after it has been automatically shut down from causes such as loss of jacket cooling water or current failure.

Solenoid-operated pilot valves admit air pressure to the suction valve unloaders on the compressor cylinders. The compressor suction valves are held open for starting, stopping, or running unloaded, when the transfer switch is in the hand position—and for starting and stopping when the transfer switch rests in the automatic position.

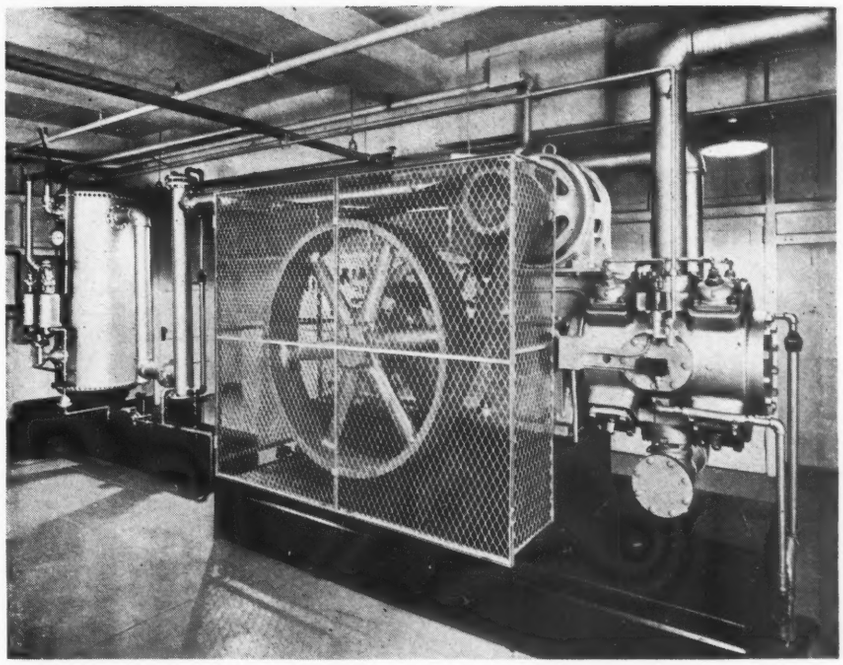


Fig. 2—Mounting the motor at this point over the crosshead brought the unit center of gravity more nearly over the foundation center, helping to reduce vibration

Each compressor unit is equipped with two solenoid-operated water valves. These are wired into the electrical circuit so that the cooling water passes to the cylinder jacket whenever the unit operates and to the aftercooler when the machine runs loaded.

A thermostat in the air discharge from each compressor is wired into the motor starting circuit so that any undue rise in discharge-air temperature causing oil vaporization will shut down the machine. Such a shutdown will not prevent the functioning of the other units in their proper sequence.

Damping Chamber

A small auxiliary air receiver, supplied through a $\frac{3}{8}$-in. line from the main air system, is installed adjacent to the sensitive pressure switches. The $\frac{3}{8}$-in. line serves as an orifice, or pressure-change dampener. Pressure in the auxiliary receiver does not fluctuate as abruptly or widely as it does in the main air system. This gives one additional compressor, started automatically, a chance to supply the increased air load, avoiding the unnecessary starting of a second additional unit, which might be needed for only a few minutes. The dependability of the control equipment is illustrated by the fact that these compressors operate entirely without attention beyond the usual daily inspection.

Air for all units comes from inside the building, and suction lines have adequate filters and separate mufflers. Despite the fact that the air was to be mixed directly with face powder, it was decided to use conventional oil-lubricated instead of the non-lubricated cylinder construction. Oil fed to each compressor cylinder was limited to one drop per minute, and only high-flash-point oil was approved for this purpose.

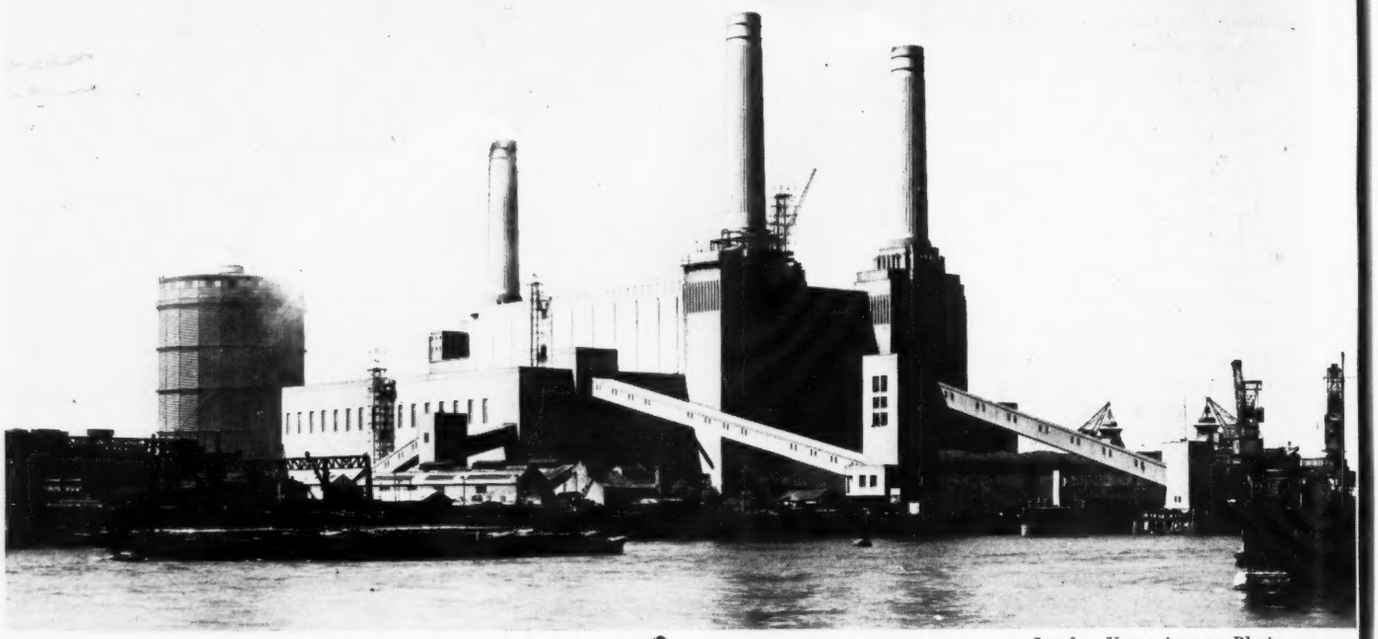
Oversize Coolers

Each compressor has its individual aftercooler and air receiver. Aftercoolers, somewhat oversize, provide a longer cooling time to give a maximum of oil and moisture separation. An automatic moisture trap expells oil and moisture separated in the aftercooler. A second trap removes further condensation and separation occurring in the receiver. Twin mechanical oil separators, Fig. 2, are installed just beyond the air receivers. To prevent discoloration difficulties the inside of the aftercoolers and receivers are galvanized, or covered with rust-proof paint; distribution-system piping and fittings are of brass.

Cold city water, ordinarily approximately 20 F lower than intake air temperature, passes through the aftercoolers, giving moisture-free air at point of use. Oil gives no trouble because only the minimum quantity needed goes into the cylinders. As this oil has a high flash point and remains liquid, it can be separated successfully. This has resulted in a complete lack of carbon formation.

Using non-corroding materials throughout the system, oversize coolers, and thermostatic protection prevents contamination from oil vapor or rust.

Generating Plants in the Blitz



London News Agency Photo

Planned emergency procedures, bomb protection and provision of emergency spare parts enable Britain's utilities to maintain service in spite of bombings

By SIR JOHN DALTON

Manager and Secretary, County of London Electric Supply Co and Associated Companies

▶ When American representatives of the power industry came to Britain to study wartime conditions they missed the spotless turbine rooms and cathedral-like boiler houses of prewar days. They saw that these buildings contained queer-shaped structures of brick and steel; they noted an absence of windows; they saw roofs reinforced and walls sandbagged. Small brick sentinel boxes in turbine and boiler rooms provided shelter for operators, while permitting necessary observation of switches and control gear.

The Americans saw fully equipped ambulance units at each station; fire-fighting appliances with their attendant squads of men; air-raid-precaution personnel with all the paraphernalia of their duties; and roof spotters for detecting enemy aircraft.

Preparations for the wartime functioning of British utilities began many months before war broke out. When hostilities started large stocks of spare plant and equipment were already dispersed over the country at strategic points so as to be available for temporary use by any company in the event of damage following attack. This spare plant was placed under the control of the Central Electricity Board, which was given powers of borrowing for the provision of such plants.

Company Obligations

In addition, an obligation was put upon all utility companies to secure their due functioning in the event of enemy attack. This naturally called for some closer interpretation of what was meant by "securing the due functioning" of a company, and eventually an interpretation was reached whereby the precautionary measures which electricity companies were expected to carry out at their own expense were:

1. To train members of their staff in the various air-raid-precaution services (first-aid, fire-fighting, decontamination), and to provide the necessary accommodation, equipment and materials

2. To make arrangements for the conveyance of air-raid warning messages within their premises, and for any emergency system of communication

3. To augment existing fire-fighting arrangements

4. To render premises dark by night and undertake any necessary camouflage painting

5. To provide refuges for their work people.

These matters became known as "good employers' obligations."

Other expenditure in the way of building blast walls and steel coverings, and for reinforcing plants and machinery, had to be approved by the Electricity Commissioners, and the undertakings could claim a grant to cover up to one-half of the expenses.

Preparation on the transmission systems was equally well advanced. It became necessary to organize standby squads to effect restoration of damage, and while it is not possible to lay down any hard and fast rule, especially in the case of small companies with limited personnel, the necessary organization had to be designed to fit the needs of

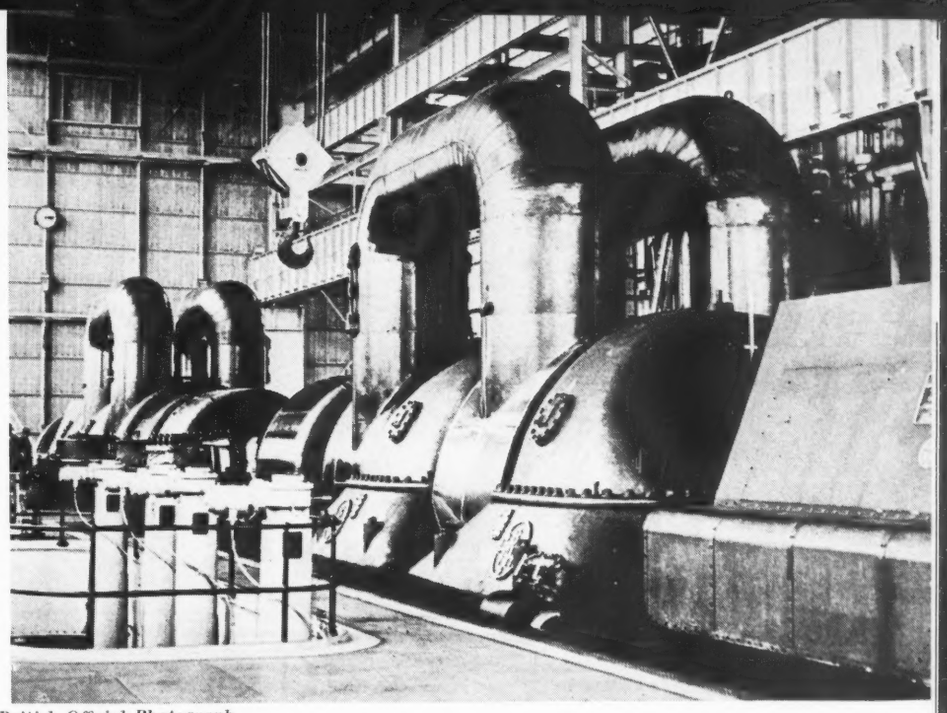
each particular undertaking. For example, in the larger companies these squads of men stay on duty day and night, whereas in the smaller companies local arrangements are made for men to report, in an emergency, to a place already indicated to them, or to be collected by the engineer in charge of the restoration party.

Did these planned precautions prove effective under actual "blitz" conditions? The answer is that, while suffering intense and continual bombardment, the electricity supply has been maintained without serious damage.

Mutual-Aid Groups

Experience has, however, dictated the necessity for what are now known as "mutual-aid groups," and throughout the country neighboring electric companies have been formed into such groups, comprising some five or ten companies who frame their own means of communication and are able to call upon each other for help where damage has occurred. It is generally agreed that the financial side of any assistance rendered by one to another shall be on cost basis only.

All these precautions to protect plant and personnel might have resulted in so much wasted expenditure had not the morale of the personnel been excellent throughout. During the first air raids of the war there was a general order that everybody, other than operating personnel, should take cover. The frequency of air-raid warnings and actual raids, however, spread familiarity and contempt, and the general order regarding taking cover came to be tacitly disregarded. Most of the workers wanted to stay at their posts. It became necessary, after a time, to order such staffs as were not immediately needed to the shelter.



British Official Photograph

These 75,000-kw turbine generators in Barking Power Station, largest in Great Britain and probably Europe, carry on in spite of the blitz

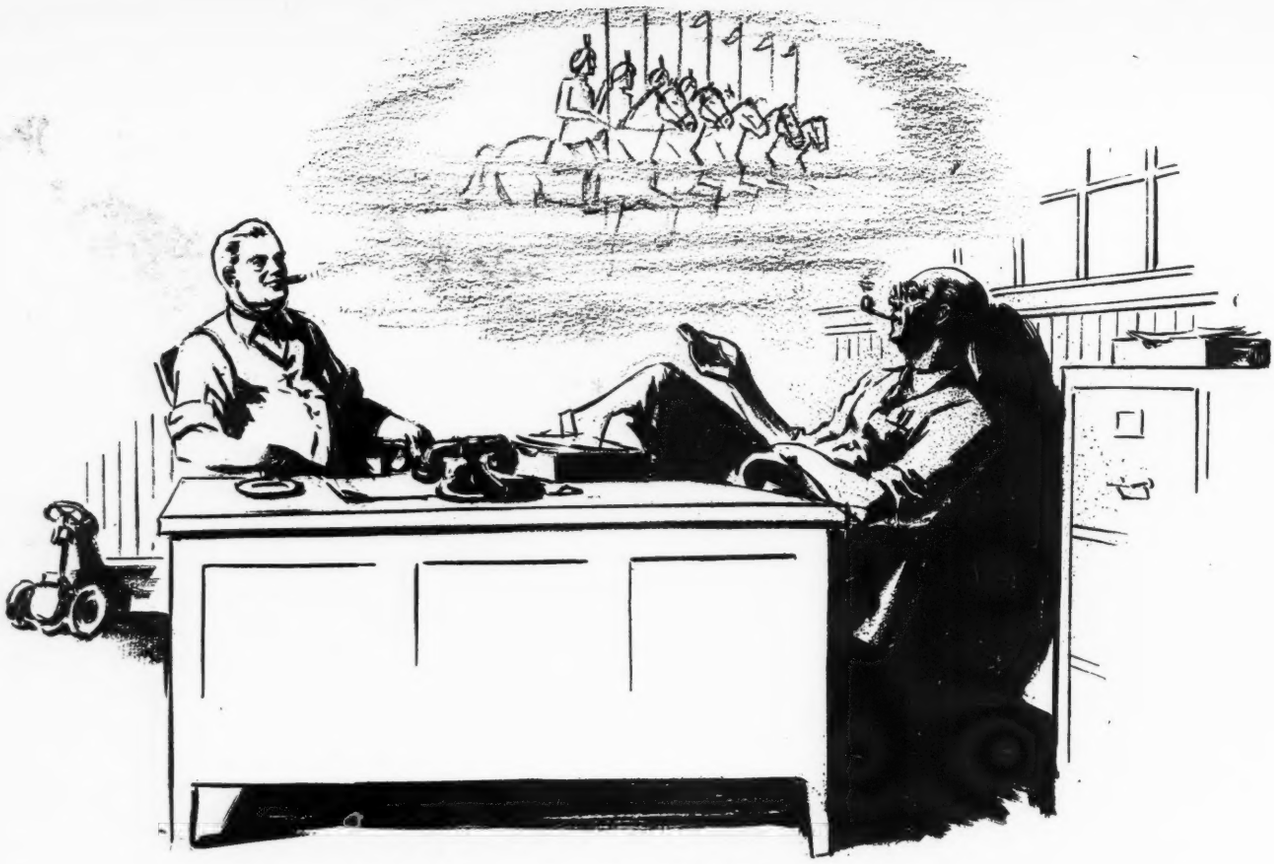
Transmission staffs stood by to effect repairs to main cables, and the repair gangs were on the roads in a matter of seconds after "control" had reported that a particular line was down.

Experience disclosed the necessity, in crowded areas, of coordinating repair work at night time with operations of gas and water companies. Generally speaking, it was the two services of gas and water which required more urgent treatment than electricity, particularly in the dark. Difficulty in performing repair work in the dark, with restrictions on lighting, led to development of a system whereby, as soon as daylight comes, repairs to damaged services of any of the public utilities are given priority among themselves, according to the needs of the moment. When all repairs are done a regional labor force fills in the road craters, and so on. Each repair-squad member performs certain specialized duties and carries the necessary tools for these operations, as well as protective apparatus for use in event of gas attack. A qualified engineer accompanies each squad.

This forearming of the service, combined with the view which the operating staff of utilities companies appear to have, that each one of them is blessed with eternal life, has resulted in maintenance of service without serious damage. The industry has experienced severe blitz conditions, and it is my opinion, in the light of experience, that we can defy anything which may come along and maintain the work of supplying the munitions plants and shipyards.

Trained repair squads go into action at a moment's notice to maintain service

British Official Photograph



"I can close my eyes and see that regiment on parade"

Saluting My Good Friend Mr Harry Carey-Kerr

Jos Hays renders thanks to the man who shoved him into the instrument business—with side remarks on the Bengal Lancers and other matters

▶ Mr Harry Carey-Kerr, formerly of E H Sargent and Co, dealers in laboratory equipment and supplies, Chicago, can never be disassociated in my mind from the early days of the instrument business which I founded and which is now owned by The Hays Corporation. Mr Carey-Kerr advised me when I was selecting and shaping the very foundation stones. I had gone to him for advice. I said:

"Mr Carey-Kerr, a gas-analysis instrument is indispensable in my business. I can't take the boiler room to a laboratory and I can't take a laboratory into the boiler room. I have tried the standard Orsat, the Morehead and the Hempel. They are all too slow and too fragile. I must have something fast, small and portable—something that I can carry with me in my travels, pack in a suitcase when fully loaded with all chemicals and it must be protected from breakage against everything except unusual hazards.

"Isn't there something on the market that will meet my special requirements? I have no time to design instruments and play around with them until I know that I have what I want. I am a consulting engineer. I don't want to go into the business of manufacturing chemical instruments."

Do It Yourself

He replied, "Mr. Hays, there is nothing on the market that will fit your specifications. You are the first man who ever came to me with a story like that. I have no doubt that such an instrument can be designed and built, but that will take time and money. After you have built it you will be sure to find something wrong with it. It will take a lot of time and a lot of money to get the bugs out of it. Don't fool yourself. If you really must have such an instrument then you must rely on yourself; design it, try it, redesign it and keep on taking your medicine until you get what you want. Make up a sketch, as best you can, bring it in to me and I can then tell you whether your design is going to be practicable from a glass-blower's standpoint."

I used a lot of Mr Carey-Kerr's time before I had what I wanted—the burette and jacket of the Hays Orsat as it is today. But it was inconvenient to fill and empty the water jacket every time that I used the instrument. I told Mr Carey-Kerr about that. He said, "Hays, I think that I have exactly what you want." He showed me a patented rubber stopper made by the Kant-Leak Stopper Co of New Haven, Conn.

This device consisted of an ordinary soft-rubber stopper, to go inside the bottle neck, and a flexible rubber cap to snap over the outside of the ring or ferrule at the top of the bottle neck. The two were molded together as one.

(*Continued on page* 142)

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

How to Overhaul Direct-Acting Reciprocating Steam Pumps

Stephen M Elonka outlines a step-by-step procedure from his experience for maintaining direct-acting steam pumps and suggests methods of doing the work

RECIPROCATING STEAM PUMPS are not only highly reliable, but when they get in a bad state of repair, either through long service or neglect, they are comparatively easy to recondition. I have overhauled many of these pumps after they had reached a condition where it was hard to understand how they kept operating. Here are some of the troubles that I have found and how they were repaired.

Frequently, opening the steam end showed a shoulder worn at each end of the cylinder. These shoulders occur if the ends of the cylinder are not counterbored, or if counterbored, result from the piston short stroking. It is not practical to fit new piston rings into such a cylinder without first removing these shoulders. If the diameter of the cylinders within the shoulders amounts to only 1/16 in. smaller than the worn part, then the rings will have to open almost ¼ in. after they pass through the shoulder, excessive for new rings. Even if new rings were installed they would probably bump the shoulders when the piston reached the end of each stroke. This would shorten the piston stroke, increase wear on a reduced length of the cylinder and cause unnecessary lateral wear on the rings and their grooves. The rings continually open and close, wearing the sides of rings and grooves.

If the bushing in the bottom of the packing box has been worn to a loose fit around the piston rod then the piston rides on the bottom of the cylinder. This will make the piston travel along the cylinder bottom take the form of a shallow curve, high at the ends and low in the center. As a result the piston rod will be higher in the stuffing box at the ends than at the middle of the stroke, a common cause of steam blowing by the packing at the end of each stroke. Tightening the packing gland only results in excessive packing and piston-rod wear, making frequent renewal of the packing necessary, and increasing the steam required to drive the pump.

To remove the shoulders from the cylinder, if other means are not available, grind them out with an emery wheel driven by a portable electric drill. Fig. 1. A small grinding wheel fitted on the end of a length of ½-in. round stock will do the trick. Suspend the drill at the proper height by a small

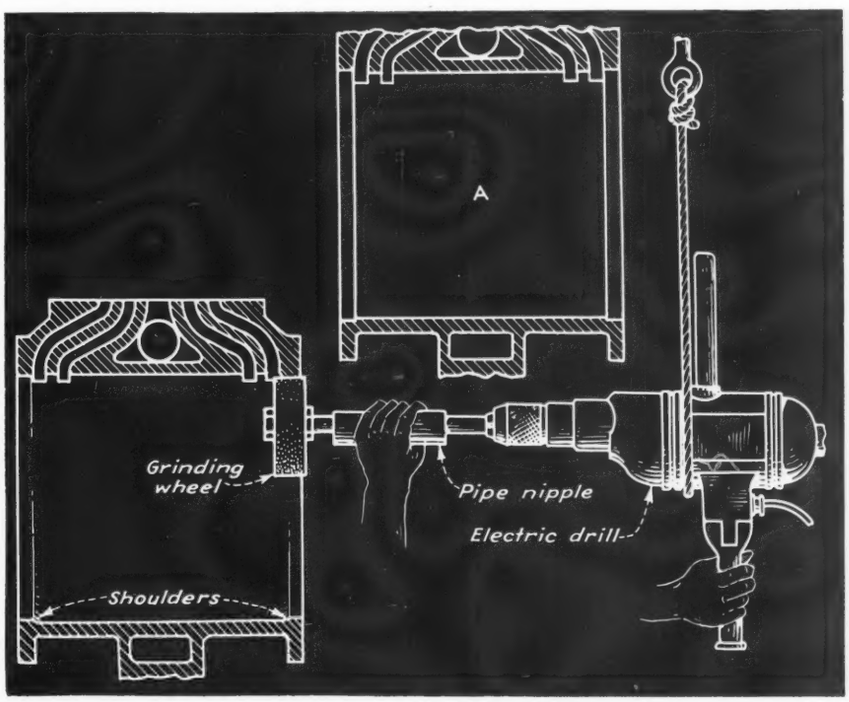


Fig. 1—Shoulders worn in the steam cylinder may be removed by a grinding wheel driven by a portable electric drill, which is supported for easy handling

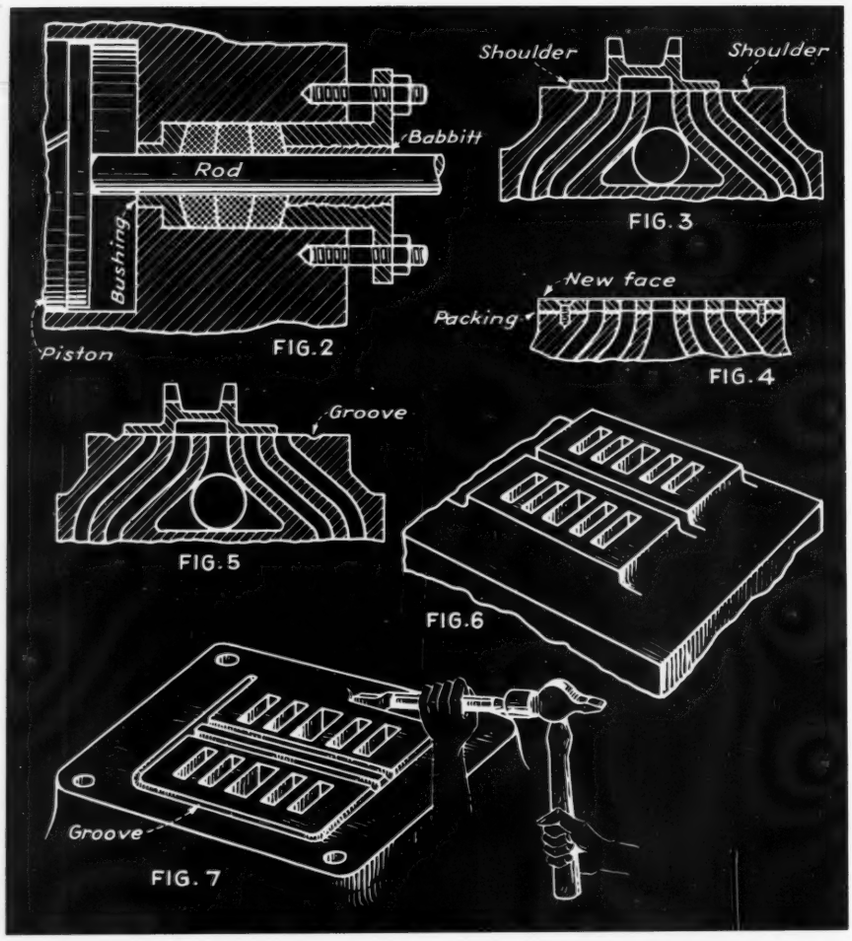


Fig. 2—Bushing in bottom of stuffing box and the packing gland should make a snug sliding fit on the piston rod. Fig. 3—D-valves may wear into their seat to form shoulder at the end of their travel. Fig. 4—A badly worn valve seat may require a new face after it has been trued. Fig. 5—A groove in the valve seat at the end of valve travel prevents a shoulder forming. Fig. 6—Some manufacturers raise the valve seat to prevent shoulder forming at end of valve travel. Fig. 7—When shoulders wear on valve seat, cut them back with a groove

rope. Place a pipe nipple over the rod for the operator's hand so that he can hold the wheel against the shoulders with force and not injure his hand. Be careful not to let the grinding wheel touch the cylinder surface in contact with the piston. Grind a slight counterbore at both ends of the cylinder, Fig. 1A, to prevent a shoulder forming again.

When overhauling the steam cylinder, replace the bushing in the bottom of the packing box, if the old one does not make a snug fit around the rod. When an old piston rod has been turned down, always install a new bushing in the packing-box bottom made to a good fit on the rod, Fig. 2. These bushings are especially important on horizontal pumps, for they keep the piston centered and prevent downward wear on the packing.

When I find the hole through the packing gland worn, I bore it out and line it with babbitt, as in Fig. 2. First bore the gland out to an enlarged size, leaving bore surface rough. Pour a lining into the enlarged hole and then machine it to a good sliding fit on the new or turned-down piston rod. Some engineers prefer to press a brass bushing into the gland every time they install a new piston rod. I prefer white metal or babbitt because when glands are not tightened uniformly the softer metal will not score the rod.

After conditioning the steam-cylinder walls we can start on the valve chest, and will assume a D-valve. These valves tend to wear down into their seat and round at their ends, Fig. 3. I have seen engineers remove the steam chest studs and file down the entire valve-seat surface, an unnecessary job. Repeating this a number of times may make it necessary to add a new face to the valve seat, as in Fig. 4.

Many manufacturers cast a groove around the valve seat, as in Fig. 5, and on some of the newer pumps raise the valve seat, Fig. 6. Either of these practices prevents the valve from wearing shoulders at its ends of travel. Shoulders at the end of valve travel cause a lot of trouble by lifting the valve off its seat, letting the steam blow by and wearing the ends of the valves round. The latter can make the pump stick on dead center when operating at slow speed, because steam leaking by the valve at both ends equalizes pressure on the piston, Fig. 8. The effects of these shoulders can be removed by cutting a groove in the seat just beyond the limit of valve travel, Fig. 7.

Length of Slide Valve

Theoretically the length of a slide valve should be equal to the distance between the outside edges of the steam-admission ports. Practically, it is better if the valve length exceeds this slightly, Fig. 9, to prevent steam leakage under the ends of the valve on dead center. This increased length compensates for uneven edges of the cast ports and also for the rounding that tends to develop at the ends of all slide valves. When slide valves are worn round at the ends, the worn part may be cut away in a planer or milling machine and the valve lengthened again by screwing a strip of metal to each end, Fig. 10.

I have found slide valves worn on the face to the point where they dropped far enough away from the stem to permit the nut to turn and disturb the valve setting. To correct this I bored and tapped the underside of the nut, when it was in correct position, for two machine screws, Fig. 11. These screws contact the valve and prevent the nut from turning.

Making new valve stems is such a simple operation that I never try to turn down the old ones unless I can't get stock for new ones. When making new stems be sure to have their threads snug in the nuts. If the nuts are loose on the stems their threads will wear and strip because of the constant bumping of the valves on the nuts. Some valves have the inside of their lugs made at an angle, Fig. 13, to make the nut jam into the stem threads and prevent them from stripping easily.

On most direct-acting steam pumps the packing-gland bushing acts as the valve-stem guide. The bushing must therefore make a snug fit around the stem and in the stuffing box, or the packing will be forced to act as a guide. The packing will then wear oval from the upward and downward thrust of the connecting rod against the valve stem, making it impossible to keep the packing tight. Packing-gland bushings

can be made so easily that there is no excuse for operating with worn ones and allowing steam to blow through the packing. When the steam cylinder and valves have been overhauled, give attention to the valve gear and renew bushings, pins and other parts. Next check the water end.

After the water end has been dismantled, replace the cylinder liner if it's worn. When I had no new liner I bored out the old one in a lathe. In the latter case the old liner must be removed without injury. This can be done by the method, Fig. 14, with a puller like Fig. 15. When a new cylinder liner cannot be pushed home with a reasonable effort, remove it and polish a light cut off its outside surface with fine abrasive cloth or a fine file. In too many cases liners have been forced to within a few inches of their proper place in the cylinder bore, only to find that they cannot be moved in either direction without serious damage.

For pumping heavy oil in either brass or iron liners I have found white-metal rings on the piston highly satisfactory, Fig. 12. These rings can be made by pouring a tin can, having a greater outside diameter than the rings, full of white metal. When the metal cools bore and turn the rings to the correct size. Narrow grooves on the outside surface of the rings act as seals. My experience showed that white metal will not wear the liners as quickly as fiber packing rings. It is the fiber in all packing, whether cotton, flax or asbestos that wears cylinder liners and piston rods.

After the valves have been renewed or properly fitted to their seats and the springs and valve studs checked, the pump is ready for assembling. Before placing each piston in its cylinder make sure that the taper on the piston rod makes a snug fit in the body of the piston. Pump rods have broken in the threads, because the taper on the rod did not fit properly in the piston.

To get maximum service from gaskets they should be cut so that they extend inside the edges of the parts they seal. Do not place the gasket material over the joint where it is to be used and cut it to the exact size by pounding the gasket against the edge of the part with a hammer. This makes the gasket too narrow and may cause it to fail.

Recently I overhauled a high-pressure reciprocating fuel-oil pump using several of the methods described here. When the pump went into service again it handled the same amount of oil when making 64 double strokes a minute as it did before with 116. Before the overhaul, oil pressure varied 17 lb during each stroke, but only 3 lb after.

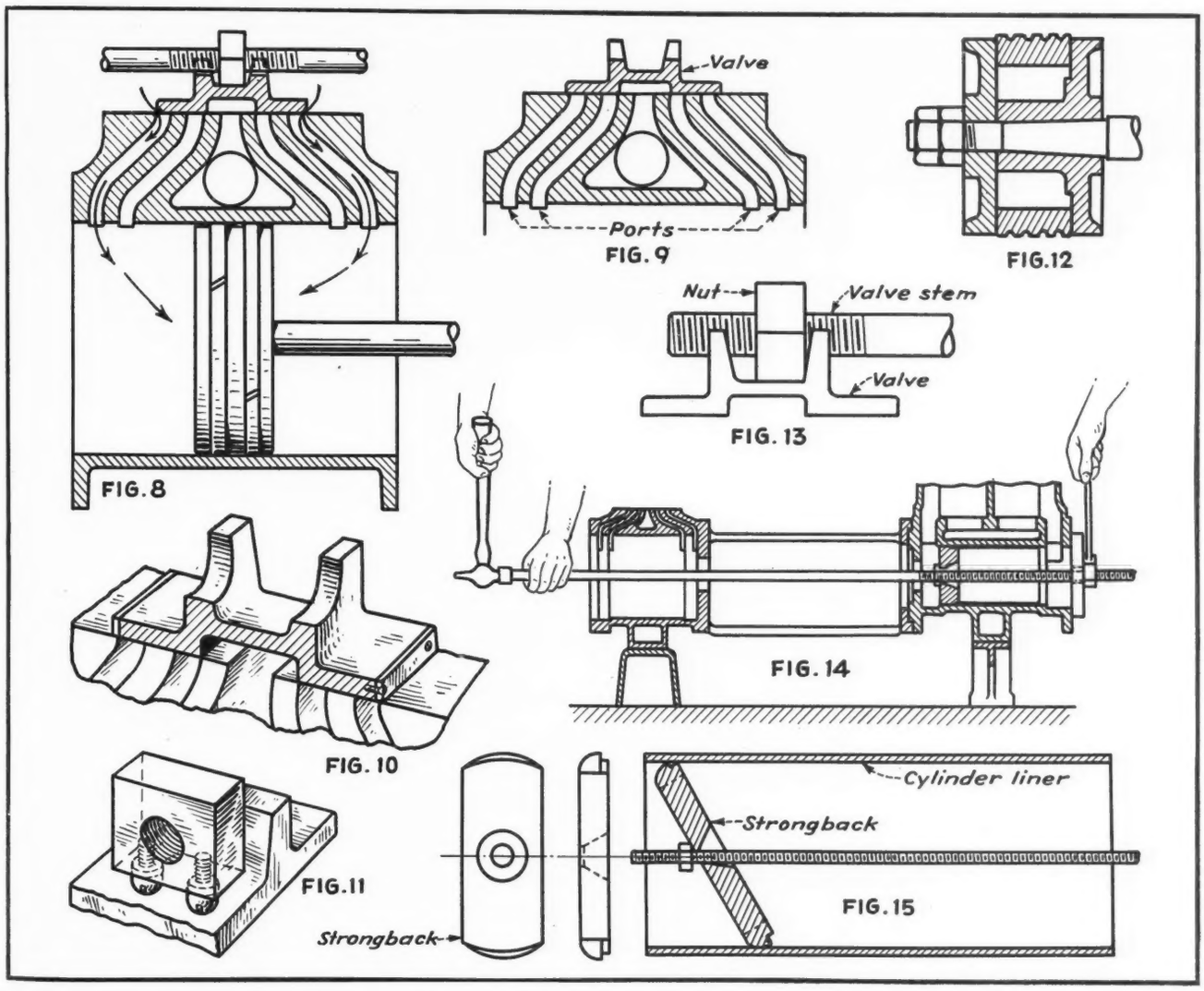


Fig. 8—Worn valve ends may cause pump to stop on dead center. Fig. 9—When valve is in mid position its ends should lap over the ports about 1/64 in. Fig. 10—If valve is too short a thin strip can be fastened to its ends. Fig. 11—Nut drilled and tapped for two ⅛-in. machine screws to prevent it from turning. Fig. 12—White-metal ring with sealing grooves on pump piston. Fig. 13—Inside of lugs on D-valve made on oblique angle so that nut will grip the valve-stem thread. Figs. 14, 15—Method of removing pump cylinder liner without injury

Correct Application Assures
UNIFORM FLAT-BELT SERVICE

R B Heller, Akron Belting Co gives some sound advice on selection and application of flat leather belts that makes for long trouble-free service

RECENTLY A NATIONAL organization made a survey to determine what master mechanics, plant engineers, superintendents, maintenance men, and others in like positions thought of different mechanical power-transmission appliances. Being a "flat-leather-belting" man, I turned at once to the section dealing with comments and questions on that commodity, and found, to say the least, the answers surprising. On almost every point there was contradiction to the point of confusion, leading one to feel that power men, whatever their abilities or positions, do not always completely inform themselves.

Conflicting Ideas

Of two chief engineers, one declared that leather belting will not meet his moisture conditions. The other said that where he has moisture and high temperatures, leather belting works very satisfactorily. How are we to reconcile these two statements? Perhaps the first engineer does not know, and he is not alone, that some belting manufacturers make full waterproof belts that will stand a lot of moisture.

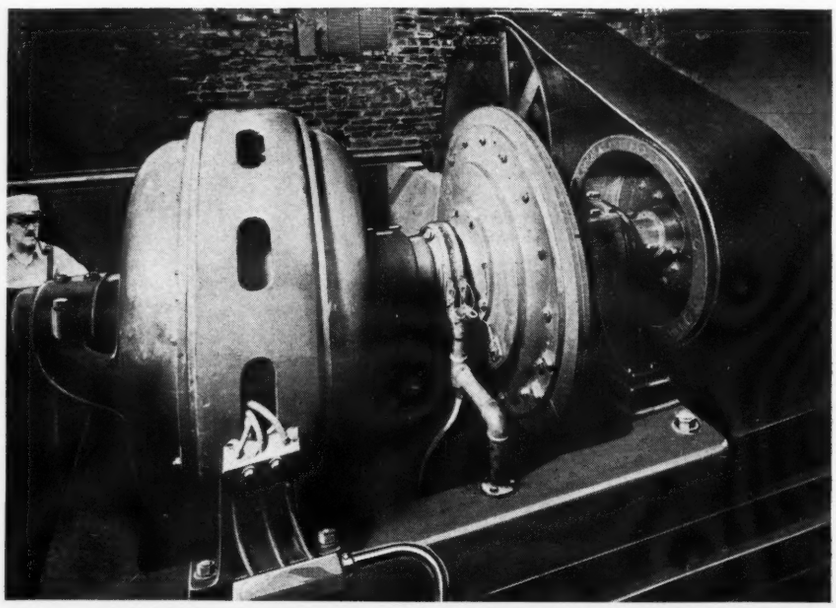
Here is an extreme case: A small flour mill stood on the bank of a river until a flood washed the bank away. The mill slid into the river, and sank. It remained that way for several years, until raised and dried out. Leather belts, made with waterproof cement, had been used, and not one lap had opened, nor had the plies separated in the double belts. A nearby paper mill uses a 16-in. double-leather belt, running from a waterwheel in a room filled with exhaust steam and water spray, and this wringing wet belt has been giving service for several years.

The idea that water injures leather is erroneous. Tanning, a wet process, keeps the leather wet almost from the start to the end. We, during our secondary tanning and currying process, wet and dry our belting leather no less than five times, and when finished it is flexible and has a high tensile strength.

When metal fasteners or rivets join the ends of the belt, the metal will be affected and trouble encountered in wet places. Join belts that must run moist or wet with an endless splice made with waterproof cement. It will work.

The second engineer cited before, doubtless, called in a good belt man, and showed him the working conditions the belt had to meet. There's a moral in that, too.

Another question raised was that



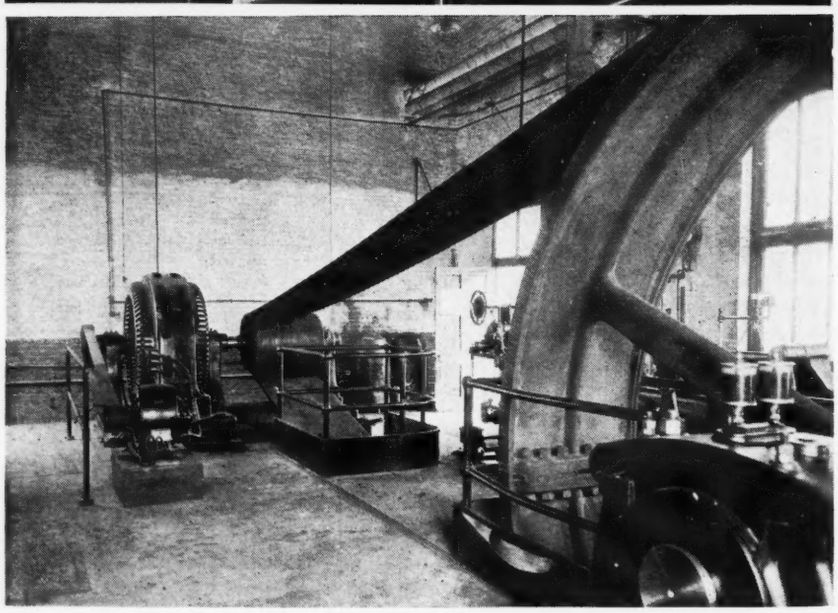


Fig. 1 (top)—A good example of a modern short-center drive. A 375-hp motor on a pivoted base drives a flour-mill lineshaft through a 34-in. 3-ply belt on pulleys with only 12-in. clearance between them. Fig. 2—In the good old days long-center belt drives like this 400-hp one were common. Modern individual motor applications are made mostly on short centers

old one of stretch. Leather is elastic by nature, and a piece of leather that has lost its elasticity is "dead." Analyses of most cases of stretchy belts show that not enough belt is being used; the belt being either too thin or too narrow. While leather has a greater overload capacity than any other substance used for belting, it can be overloaded. So can a horse. The horse will balk and the leather will stretch.

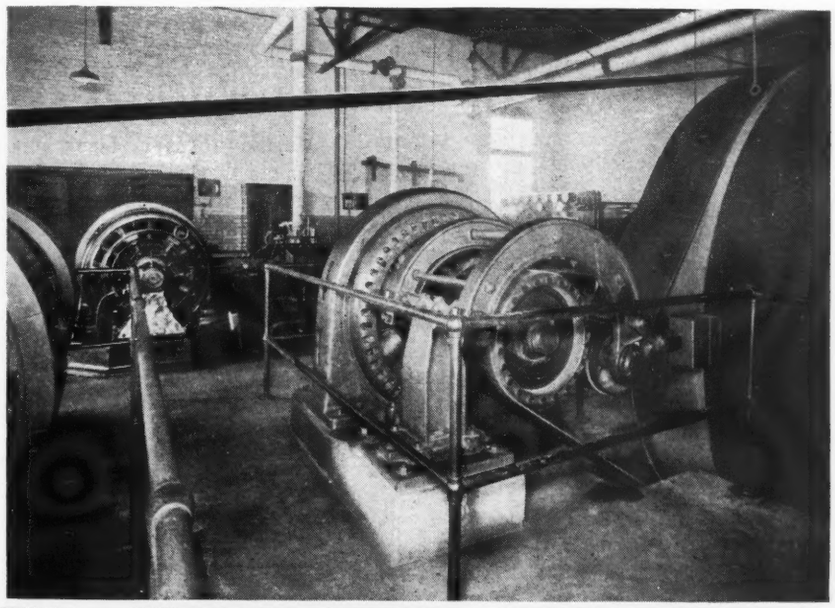
There is no good reason for an overloaded belt. Any manufacturer given the chance, will gladly furnish horsepower tables, and install the right belt. One trouble found in group drives is a tendency to add machines to the group, and expect the belt to take on all the loads added from time to time without giving trouble.

Another lot of grief can be attributed to just plain "stinginess." If a drive needs an 8-in. belt, put it on; a 6-in. one won't do the work just as well. If the operator tries to make it, he is asking for trouble. A good many times when the belt won't pull its load the fault lies with the operator. It is poor economy to splurge in buying the best in machines and then trying to clip off a couple of dollars from the belt price. If the machine costs $4000, that's the price, and it's probably worth it. Likewise, if the necessary belt costs $65, that's its price and it's worth it too. A cheaper belt will not always do the job satisfactorily.

Another engineer complains of the high price of leather belting. Price is so relative a factor that one can argue indefinitely about it. True, if one man quotes $200 and another quotes $100, there must be a difference. If the $200 belt lasts twice as long as the $100 one, and there are many such cases on record, it is much less expensive in the long run. Figure it out in terms of fewer man hours lost, greater machine production, lower maintenance cost. A good belt, correctly applied and cared for, keeps right on paying its way long after the cheap one has gone to scrap.

One engineer says: "We determine the kind and size of belts, and do not consult the manufacturer." Another engineer says: "We use a lot of leather belts, and consider them so important that we employ a man who specializes in their purchase and maintenance." Now, which one of these two gets the better results from his belts? Figures are not given, of course, but it would not be hard to guess.

No engineer should feel that it reflects unfavorably on his knowledge or ability if he asks advice from a belting manufacturer about how to belt a given drive. The belting manufacturer is a specialist in his particular line, just as the engineer is in his. "Let the shoemaker stick to his last."



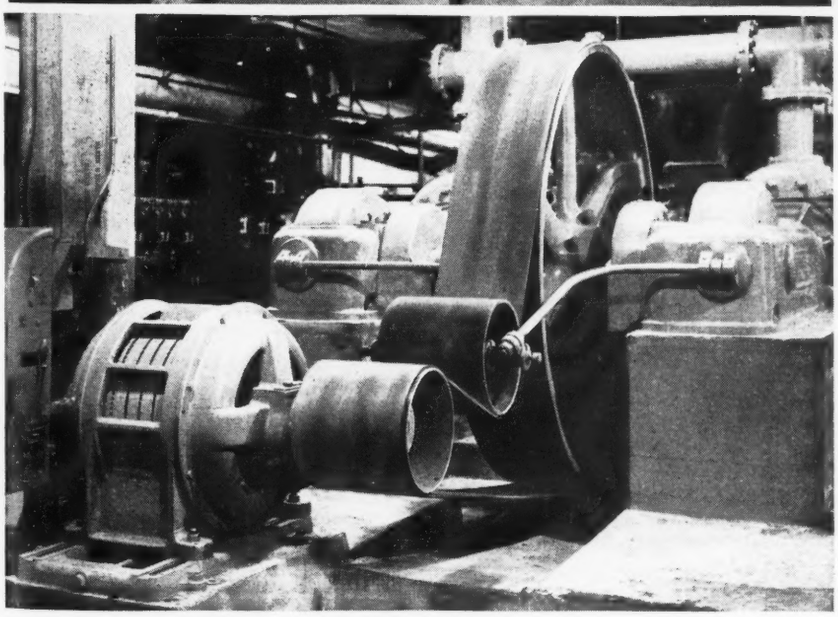


Fig. 3 (top)—On the extreme right a large belt from the engine flywheel drives a heavy mill lineshaft; from the left-hand end of the flywheel a short-center idler-pulley drive connects to a 150-kva generator. A rider belt on this drive leads off to the right to drive another lineshaft. Fig. 4—A 75-hp squirrel-cage motor drives an air compressor through short-center idler-pulley drive

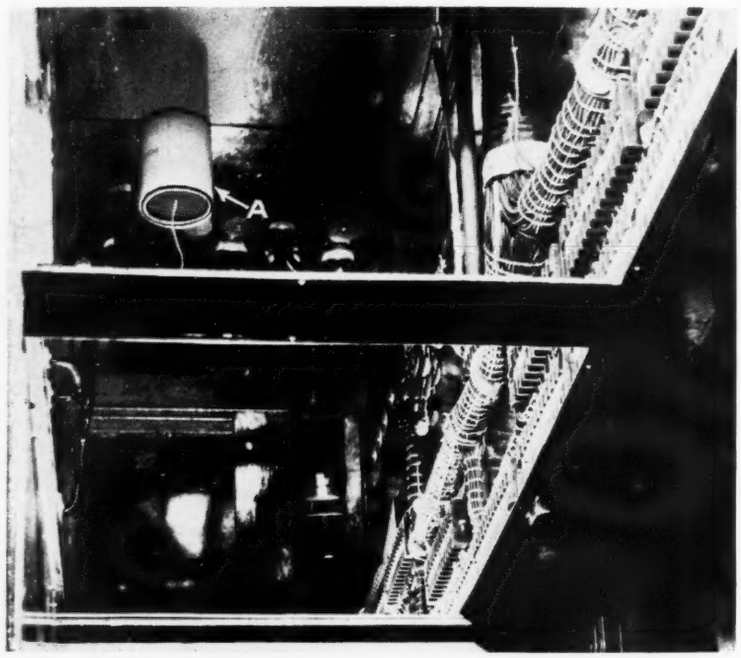
Short-Center Drives

Short-center drives provide another source of opinion differences. Many master mechanics do not realize that leather belting is made in varying thicknesses and degrees of flexibility. A properly selected leather belt will operate efficiently on such a drive and give long trouble-free service. When used with a tension-control motor base, its life and effectiveness leave little to be desired.

One engineer thinks that "belts run more frequently over the pulleys, and thus wear out faster." That sounds all right until one learns that a tension-control motor-base automatically adjusts belt tension to the load, and applies the belt as needed. Strain and slippage of an inadequate belt wears it out, not the distance it travels.

Summing up, one comes to the conclusion that if those who are in charge of power transmission by belting will put their problems before reputable belting manufacturers, and heed their opinions, which are usually based on hard-won experience, much more satisfactory results will be attained, and a good deal of money saved.

PRACTICAL AIDS TO OPERATION



Can Eases Twine Problem

WHEN THE ELECTRICIANS were wiring the air-conditioning-system signal board in the new home office building of the Metropolitan Life Insulance Co, New York City, very heavy cable work was required above the board where all the wires came in from over 200 points on the system. These wires were carefully laced with twine into cables as shown in the right-hand side of the photo.

The ball of twine, if left free, particularly in close quarters above a panelboard, was always getting lost or out of control. On this job the problem was solved by fastening a pressed-in-cover tin can, bottom up, to the ceiling of the inclosure as at *A* in the photo. With the end of the ball of twine brought down through a hole in the cover, the ball was put up into the can and its cover pressed into place. After that when the electricians wanted twine they pulled out the desired length and cut it off without having to bother about where the ball might be.

FIELD EDITOR

Wound Rotor Changed to Squirrel Cage

WE HAD A 100-hp, 600-rpm, 3-phase wound-rotor induction motor and we wanted to boost the speed to 900 rpm to increase the motor horsepower and also to make its speed suitable for direct connection to the machine it was to drive. The driven machine could be started readily with a squirrel-cage motor, so to simplify the change-over we decided to convert the motor to this type.

First, we carefully removed the coils from the stator and spread them from a pitch of 1 to 10 slots to 1 to 12. After this operation they were thoroughly dried in an oven, given a good coat of varnish and baked hard. We then rewound the stator for 8 poles instead of 12 and grouped the coil 4-parallel star instead of 3-parallel star as in the original winding.

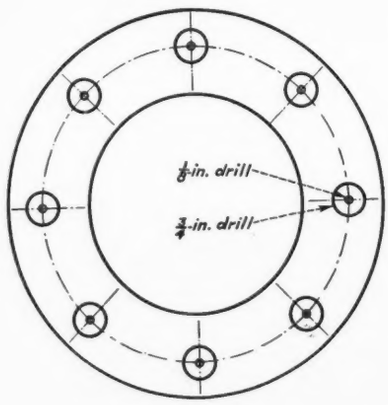
The rotor had a bar winding with the bar ends connected with clips. We removed the steel wire bands holding down the ends of these coils and thoroughly cleaned the ends. We then made copper filling pieces to go between the ends of the coils. These pieces were slightly tapered and tinned and then driven radially between the coil ends. They were soldered in place to form a solid ring at both ends of the winding.

After truing the ring in a lathe and replacing the steel-wire end bands, the rotor was found to be in good balance. We removed the brush rigging but left the sliprings and their connection intact. During over a year's practically continuous service driving a 130-hp load the motor has performed satisfactorily.

Philadelphia, Pa. R O SPENCER

Spaces Holes Accurately With Small Drill

WHEN DRILLING HOLES in blank pipe flanges I found that no matter how accurately they were laid out, the holes in the two flanges of a joint did not line



up when we installed the pipe. As a result we frequently had a lot of filing to do to get the bolts in place. It was apparent that the large drill must have wandered to one side of the center punch marks. This led to first drilling the holes with a ⅛-in. drill as indicated in the diagram, and then using the large drill. By doing this we get the holes spaced more accurately and have eliminated a lot of the filing we used to have to do to get the bolts through the holes.

New York, N. Y. S M ELONKA

Guide Improves Pump-Valve Operation

AS ORIGINALLY INSTALLED in our reciprocating boiler-feed pumps, the valve springs rested directly on the disks. Also the top and bottom surfaces of the

ribs in the valve seat were on the same level as the rest of the seat, as in Fig. 1. These ribs caused the under surface of the disk to wear unevenly, seat improperly and leak. The hole in the center of the disk wore, permitting it to lift unevenly and increasing the possibilities of the valve not seating properly.

To eliminate these difficulties I removed the valve seats and undercut their ribs, as in Fig. 2. I also made a combination valve spring case and valve guide from brass stock. This guide has a short neck on its bottom which fits down into the valve disk to prevent the hole from wearing. These changes have made unbelievable improvements in pump operation. Before the changes, were made, valve disks had to be renewed as frequently as every 2 months. The present sets of disks have been in service for 3 years and are still in good working condition.

Englewood, N. J. R BOETTINGER

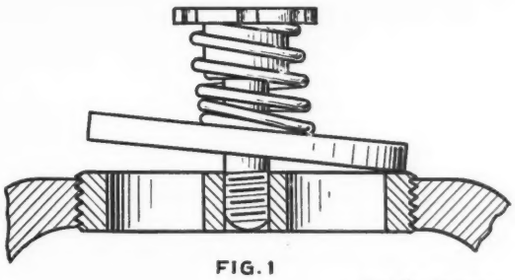


FIG. 1

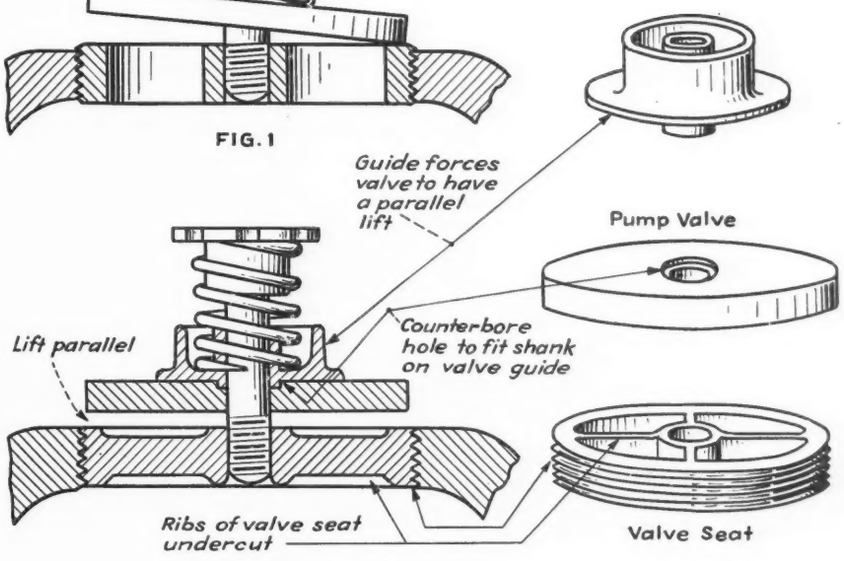

Guide forces valve to have a parallel lift
Pump Valve
Lift parallel
Counterbore hole to fit shank on valve guide
Ribs of valve seat undercut
Valve Seat

FIG. 2

Firing Truck Improves Boiler Operation

OUR BOILERS ARE HAND FIRED and originally the coal was brought in by wheelbarrow from the bunker and dumped on the floor in front of them to be shoveled into the furnaces. This was objectionable for several reasons: the boiler-room floor was always cluttered up with coal and we could not weigh the coal to the boilers.

In looking for a solution of this problem we decided upon a plate-steel truck with a body, 71.25 x 32.5 x 28.5 in., that would hold exactly one ton of the coal we were firing, when level full. One side of the truck body can be dropped to approximately a horizontal position and the coal shoveled from it into the furnace, as in the photo. This makes firing easier.

Steel plates at each end of the drop side serve as extensions of the truck body ends to prevent from coal falling on the floor when the side is let down. When the truck is empty a hook at each end holds the side in place. We have two of these cars; one can be loaded by the fireman at his leisure while firing from the other. The cars roll on two anti-friction bearing casters at each end. At one end the casters are fixed and at the other they rotate through 360 deg.

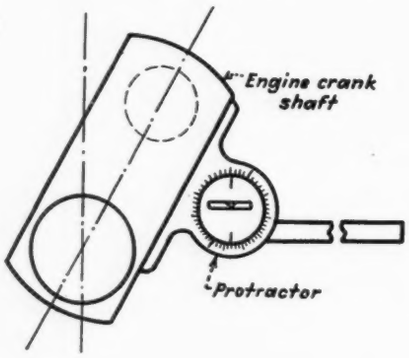
These trucks have done everything expected of them. First, they have made the firing job easier and made it possible to keep the fire-room floor clear. This method of weighing the coal has proved to be almost unbelievably accurate, when compared with the delivery weight, checking consistently within a few hundred pounds each month. There are three main reasons

for this: our coal is purchased on specification and we therefore get a fairly uniform grade; the fireman makes an honest effort to get trucks accurately filled; and the truck body is so large that no mistake can be made in the count of loads used, as can happen when measuring coal in wheelbarrow loads.

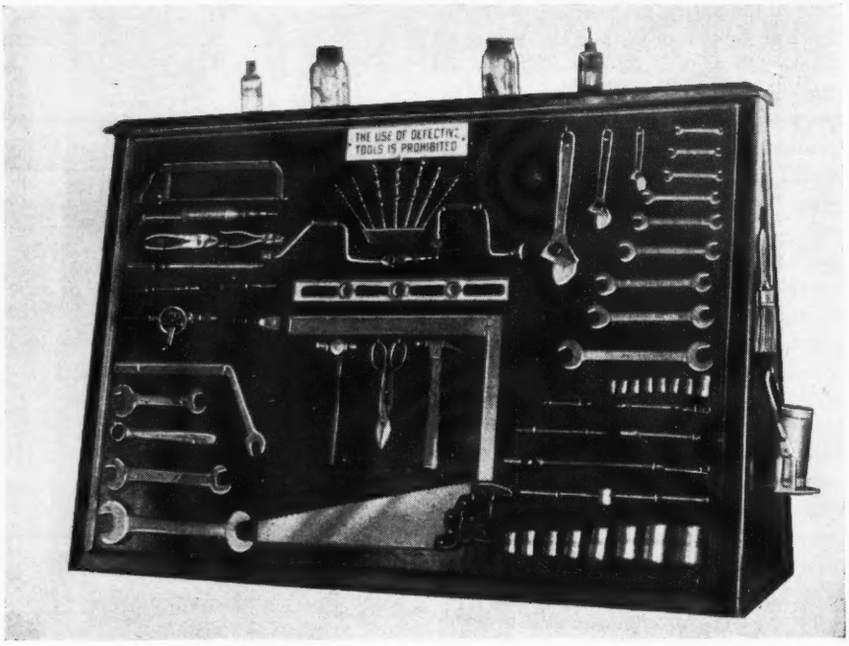
New York, N. Y. RALPH B ALLEN
Chief Engineer,
Washington Life Building

Measures Crank Throw With Mechanic's Level

THE DIAGRAM SHOWS my method of determining the angle of crank throw, often necessary in the operation of



internal-combustion engines. I have operated this type engine for many years and have not seen this method offered by any of the engine manufacturers, yet I find it the simplest and quickest to apply. To measure the crank angle, place the protractor head of a mechanic's square against the crank throw, adjust the level to level position and read the angle from either vertical or horizontal directly from the protractor. This is simpler than measuring the periphery of the flywheel, dividing this into 360 parts, establishing dead center and attaching a scriber. Other operators may not have thought of this idea. It took me years to stumble onto it but I wish I had discovered the idea years ago, because it has since its adoption proved useful many times.



Tool Board Combines Convenience and Safety

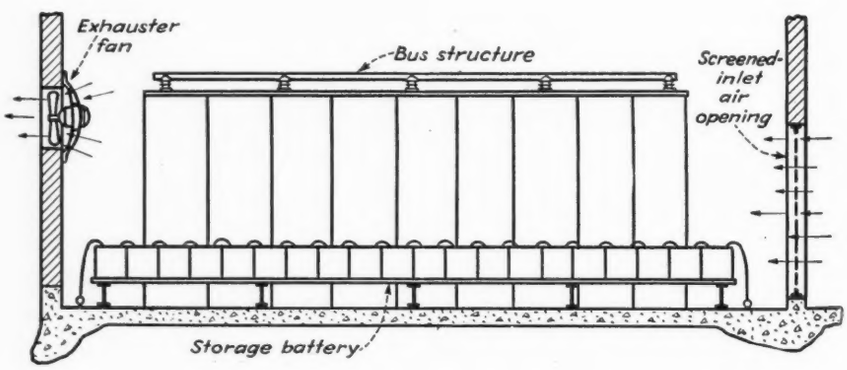
PRACTICALLY EVERY ENGINEER has his pet ideas about a tool board so maybe I will be permitted to add another. A midcontinent oil company which operates a large number of power installations in various parts of the country has adopted a uniform type of tool board for its power plants. The board is made with a pine backing, faced with plywood with a molding at the sides and ends, completed by the application of several coats of durable varnish. The tools most frequently used are laid out in a pattern on the face of the board and pins and hooks set in the wood for hanging each tool separately. New employees quickly become familiar with the board and any required tool can be lifted from its hook support. Following up the general scheme and applying a cardinal rule of safety, a notice is fastened to the top of the board, see top center of photo, which reads: "THE USE OF DEFECTIVE TOOLS IS FORBIDDEN."

Santa Monica, Calif.
JOHN C ALBRIGHT

Proper Ventilation Stops Corrosion

WHEREVER STORAGE BATTERIES are used there is always danger of corrosion of metal parts from the acid fumes, particularly if the battery remains continuously on trickle charge. To add to this difficulty, battery rooms are frequently neither properly ventilated nor segregated from the rest of the plant. This was the problem we faced with the storage battery in our plant and we had to do something about it because the fumes were getting into the plant and causing serious corrosion difficulties.

On the inside wall of the battery room we cut a hole near the floor about 3 ft square opposite one end of the battery. In this hole we installed a wire-mesh screen painted with bitumastic paint. In the outside wall of the battery room we installed an exhaust fan on a level with the top of the battery,

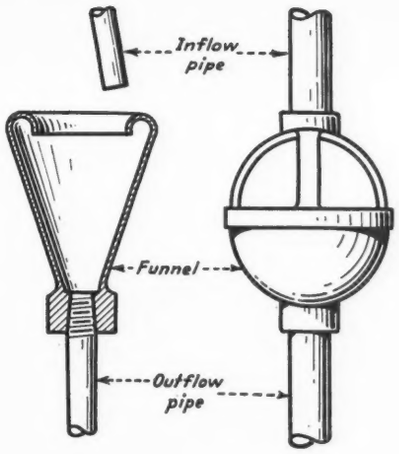


as in the figure. This ventilation system has served two purposes. First, it keeps the acid fumes out of the plant and battery room, and, second, it ventilates the oil-switch gallery which was not properly ventilated before, even though needing it badly.

Richmond, Va. C R ANDERSON

Get Rid of That Messy Funnel

TO DETERMINE IF WATER or other liquids are flowing down a pipe line and to permit regulating this flow by a manually operated valve, the pipe is broken at a convenient point and the free end allowed to discharge into an open



funnel. This break in the pipe creates a problem of alignment between the discharge end of the pipe and the funnel, and of fastening the loose pipe ends to building wall or machine frames. It has been my experience that the alignment is generally so bad that the liquid splashes out of the funnel even when splash-proof funnels, left, are used. Funnels are available into which both free ends of the pipe can be threaded, right. Such funnels are commonly used on water-cooled compressors and internal-combustion engines, but for some reason they have not a wide acceptance around industry plants. When you have a messy spot around the plant from an open funnel, get rid of it by using a design like that shown at the right.

New York, N. Y. ARTHUR H KORN

Operating Precautions For a Compound Engine

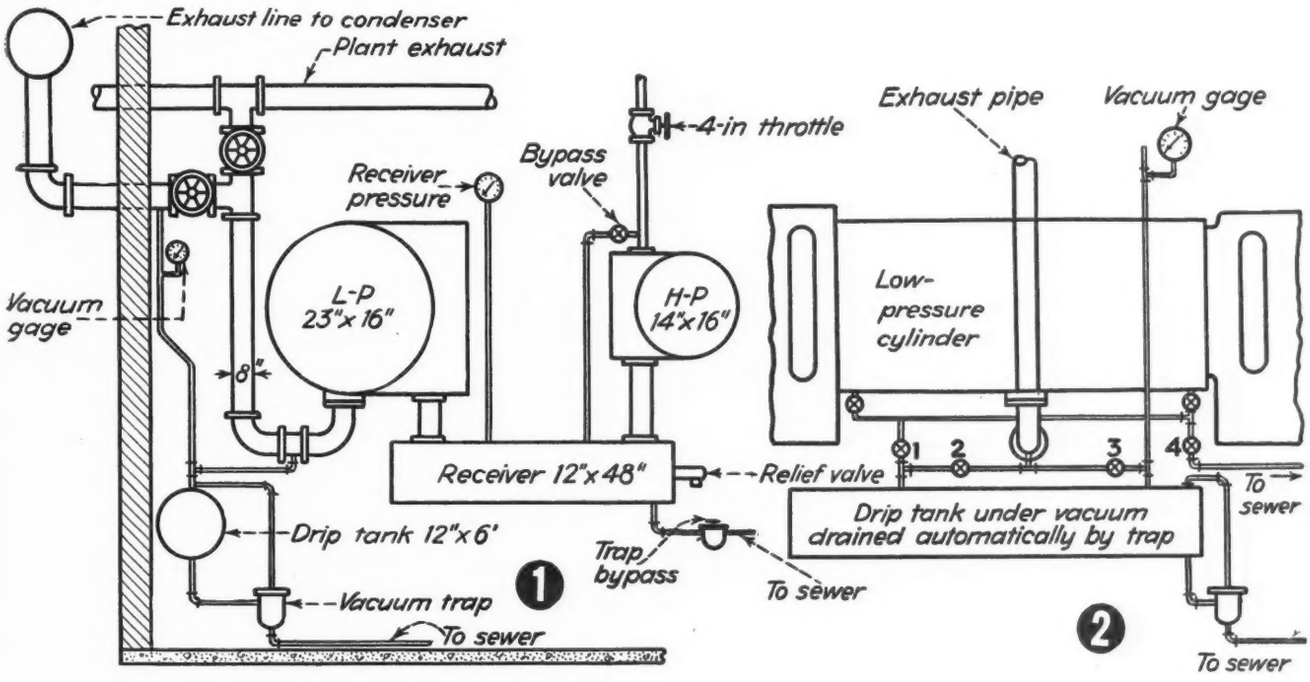
SEVERAL CROSS-COMPOUND condensing steam engines have been damaged by water passing from the receiver into the low-pressure cylinder. When I converted a non-condensing engine of this type for condensing service I had this danger in mind and gave considerable attention to the piping and the method of starting the engine so as to drain the cylinders and receiver properly. Fig. 1 and 2 show the piping arrangements.

To warm up the steam cylinders and receiver, the throttle valve is cracked about ⅛ turn, the valve in the bypass from the high-pressure steam line to receiver, and the bypass valve on the receiver trap being open. The exhaust valves are kept closed, bleed valves on the high and low-pressure cylinders open, valves 1 and 2, Fig. 2, closed and valves 3 and 4 open. After about 10 min the cylinders and the receiver are warm and free of water because there has not been a vacuum in the engine to restrict condensate flow.

With the condenser in operation, we closed the throttle, the valve in the bypass to receiver, and valves 3 and 4. We opened valves 1 and 2 and the exhaust valve. Then we open throttle until the engine starts running. This puts pressure on the receiver to force any condensate that may be in it through the trap. Bleed valves on both cylinders, valve 2 and the bypass on the receiver trap are closed. Valve 1 is left open as an outlet for water should it become necessary to open the low-pressure bleeder.

We obtain the best results by bringing the engine up to speed slowly immediately after warming up. This method has worked satisfactorily for four years. We never run the engine long periods without load, because the receiver may fill with water. In installations where it may be necessary to run for a long period without load or a load so small that positive pressure cannot be maintained in the receiver a drain to the drip tank should be provided.

Buffalo, N. Y. R E FONTAINE



How to Figure Beams—No. 6

By PHIL SWAIN

EVERY CARPENTER KNOWS that a 2 x 8 beam is much stronger on edge than flatwise. Fig. 1 shows that increasing the *width* of a rectangular beam raises both strength and stiffness in exact proportion.

On the other hand (Fig. 2) strength and stiffness increase much faster than material added if the material is added in *depth*. Strength goes up in proportion to the square of the depth, and stiffness in proportion to the cube of the depth. Thus, comparing the 5 x 1 beam with the 1 x 1, relative material used is 5, relative strength is 5 x 5 = 25 and relative stiffness is 5 x 5 x 5 = 125.

For a round section (Fig. 3) area and weight go up as the square of the diameter, the strength as the cube and the stiffness as the fourth power. Thus, for 3 in. rod compared with 1 in., weight is 3 x 3 = 9 times, strength is 3 x 3 x 3 = 27 times and the stiffness is 3 x 3 x 3 x 3 = 81 times. For a 4 in. rod the weight is 16 times, strength 64 times.

Contrary to common belief, a rod with a hole in it is somewhat *weaker* in bending than a solid rod of the same outside diameter. However, the metal saved by hollowing the rod is always more than the loss of strength, mostly with the first metal removed at the core. See Fig. 5.

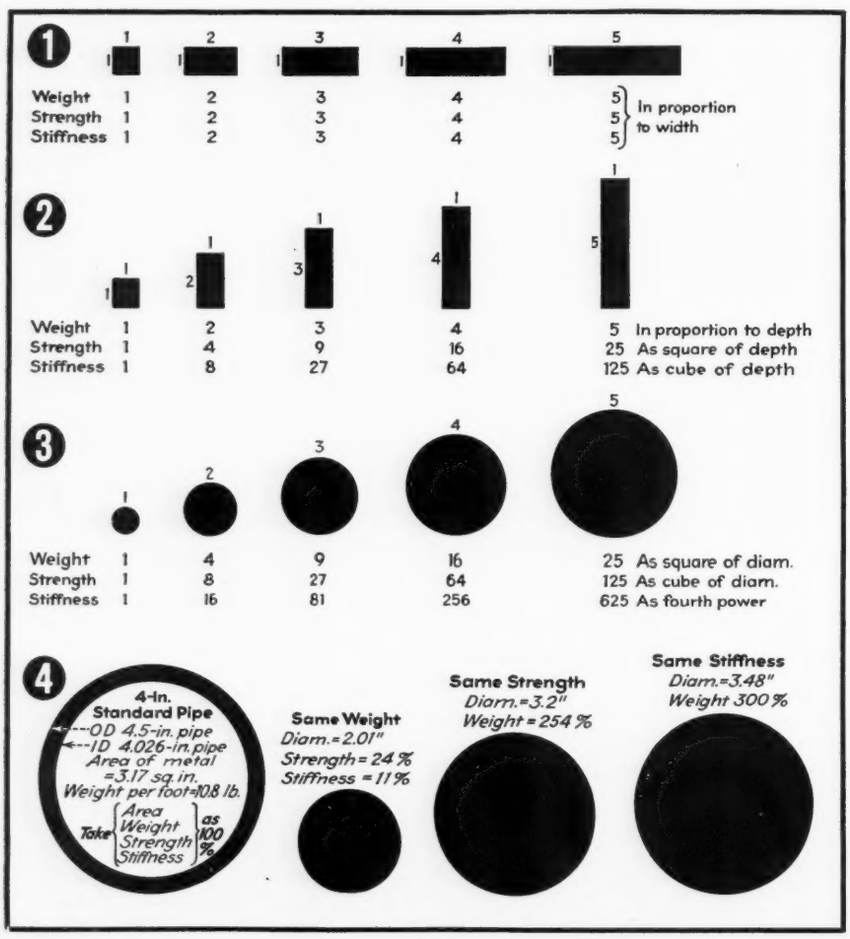
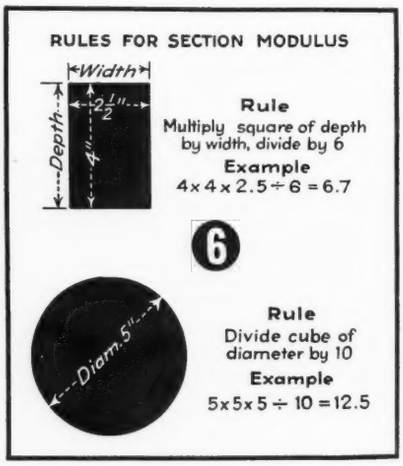


Fig. 1—Strength and stiffness are proportional to section width. Fig. 2—Strength increases as the square of the depth and stiffness as the cube. Hence deep-narrow beams are economical of material. Fig. 3—For round sections weight goes up as square of diameter, strength as cube and stiffness as fourth power. Fig. 4—Standard 4-in. pipe compared with three solid rods having same weight, strength and stiffness

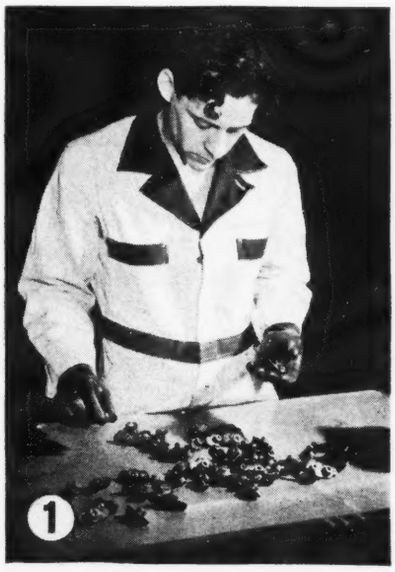
Fig. 5—Removing metal from center of round reduces bending strength first slowly, then rapidly, but metal saved is always more than loss in strength

On the other hand, tubes are much stronger, *weight for weight*, than rods. Fig. 4 compares a 4-in. standard pipe with solid rounds of same weight, same strength and same stiffness. Note that the solid rod of same weight is only one quarter as strong, rod of same strength weighs 2½ times as much and rod of same stiffness weighs triple the first.

If you'd like to figure out some of these relations for yourself the formulas in Fig. 6 will give you the section modulus (measure of section strength) for rectangular sections and rounds. For other sections, and for stiffness (moment of inertia) see engineering handbooks.



HOW TO CARE FOR RUBBER GLOVES



1 Wear proper gloves for each job and be sure they correctly fit the hands. Gloves too large catch or snag on sharp jagged objects. If too small they puncture easily. Industrial workers doing heavy rough jobs and men working near high voltages should wear gloves of thick, strong rubber. Gloves for use near acid should be of heavy gage. Wear light-weight gloves where finger-tip feel is desired for handling small smooth objects

2 Do not take off rubber gloves by pulling on the ends of the fingers. A pull on the fingers strains the rubber and may cause it to rupture

3 Always remove rubber gloves by taking hold of the cuffs and peeling them off inside out as shown. Rubber gloves create a suction effect when finger-tips are pulled that may snap off the tips

4 Dust inside of rubber gloves well with talcum each time they are removed. Hand perspiration clings to gloves and will make them tacky if moisture is not dried promptly. Talc also makes the surface smooth so that the hand slips in easily. Be sure hands are dry before putting on gloves. Rubber gloves are hard to put on if hands are moist or damp

5 Keep two pairs of rubber gloves available and wear each pair every other day, if gloves are used frequently. One pair worn every day wears out more quickly than if worn every other day

6 Don't hang up dirty gloves, as the accumulation of material on them may attack the rubber and shorten its life. Grease, oil or solvents are natural enemies of rubber. To make sure that no harmful substances remain on glove surfaces, thoroughly wash each glove in lukewarm water and good soap, before storing them. Rinse off all soap in cool or cold water. Carefully hang them up to dry. Store in a cool place

READERS' PROBLEMS

Questions from Our Readers

Steam for Water Heating

Question 1

IN OUR HOT-WATER HEATING SYSTEM *we use 150-psi steam to supplement low-pressure steam for heating the water. The circulating pumps handle 3000 gpm for plant heating. We supply the live steam through a 4-in. line to a T-shaped manifold. From here six lines varying from ¾ to 2½ in. carry the steam to a blank flange in the end of the l-p header. This arrangement is objectional because it produces considerable noise during extremely cold weather when it becomes necessary to open all of the supply valves on the manifold.*

Would the system efficiency be lowered if we reduced the live steam to 65 psi before admitting it to the l-p main? Would this eliminate some of the noise? Could this system be improved by installing a 4-in. automatic reducing valve for live-steam-flow regulation?—CH

Question 2

What Causes Grate Burning?

OUR 554-HP BOILERS *are equipped with twin chain-grate stokers. We have just finished replacing an 18-in. strip down the center of each grate, the only part of the grate area damaged.*

We use ordinary mine run fairly high-volatile screened coal with the ash content running approximately 12%. Induced draft fans supply draft and the boilers operate at 150% rating.

Can POWER *readers suggest reasons for this grate burning and remedies to prevent it reoccurring?—CAM*

What Causes Drop In Pump Output?

Answers to Oct Question 1

The Question

WE HAVE TWO *250-gpm 400-ft-head 2-stage centrifugal pumps, each driven by a 50-hp 3-phase motor, pumping cold water to an overhead tank against a 273-ft head. Each pump has its own intake under a 10-ft positive suction head. A 4-in. Y-connection ties both pump discharges to a 6-in. header.*

When running alone each pump discharges 330 gpm, at a pressure of 150 psi, but when operating in parallel the total water discharge is only 450 gpm at 170 psi. The total head, including friction, is slightly under the rated figure and we are unable to determine why the pumps do not discharge full capacity when operating in parallel. Could it be caused by unstable pressure characteristics affecting the spring-operated vertical check valves?—FBP

Test Flowmeter and Pressure Gages

A CAREFUL ANALYSIS of this problem will disclose to FBP that there is probably nothing wrong with the check valves but that either his method of measuring flow or his pressure gages, if not both, need careful rechecking. Two pumps will deliver, against any given total head, the sum of their individual capacities at that particular head. Thus, if each pump was designed for 20 gpm and 400 ft head, two such pumps in parallel will deliver 500 gpm at 400 ft, assuming that the pumps have met their guarantees and that they have not lost capacity through wear.

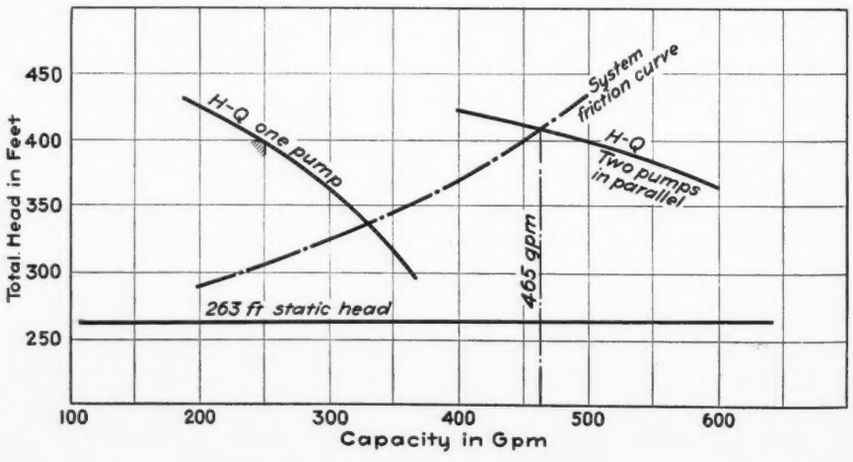
This does not mean, however, that two pumps in parallel will deliver through a given piping system twice the capacity that either of them can deliver alone. It is a characteristic of a centrifugal pump operating in a hydraulic system that its capacity will correspond to the intersection of its head-capacity curve with the system-friction curve. Such a system of curves is illustrated in the sketch shown below.

In carrying out the following calculations, it has been assumed that the 273-ft head referred to in FBP's question is the static head, that the friction losses in the suction piping are negligible and that the 150- and 170-psi references are discharge pressures. It has been further assumed that the pump meets its design guarantees of 250 gpm at 400 ft total head and, to show that the error of measurement is rather small, that the reading of 330 gpm and 150 psi discharge pressure is correct.

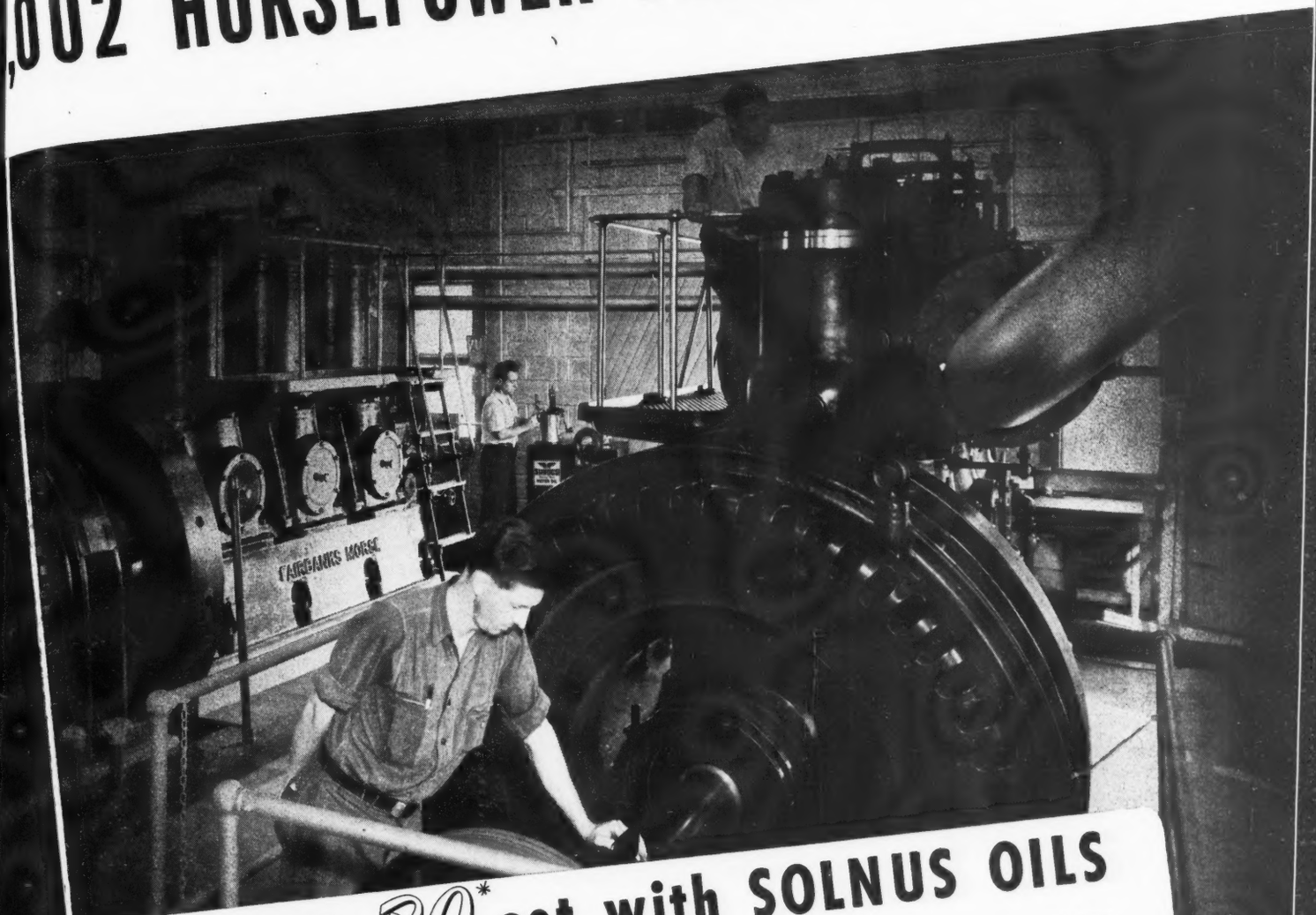
On this basis, we can develop two points in the pump *H-Q* curve, namely the design point and the total head at 330 gpm, since this is equivalent to: $(150 \times 2.31) - 10 = 337$ ft. We can likewise establish a system friction curve, since we know that the total static head is $273 - 10 = 263$ ft. and that the friction losses at 330 gpm are $337 - 263 = 74$ ft.

It will be seen that the *H-Q* curve of two pumps operating in parallel intersects the system curve at 465 gpm and a total head of 410 ft. The reason why it is assumed that the above set of *H-Q* and system friction curves is correct is that a pump which delivers 250 gpm at 400 ft can very logically be expected to deliver 232.5 gpm (one-half of 465 gpm) at a head of 410 ft. If, on the other hand, we had assumed that the 170-psi reading was correct, it would appear that the pump, when operated in parallel delivers 225 gpm against 383 ft total head. These conditions are not probable, unless the

(*Continued on page* 122)



,002 HORSEPOWER HOURS PER GALLON



HIGHER P-Q* set with SOLNUS OILS

This diesel owner knew from past experience that of all the lubricating oils he had used, Sun SOLNUS OILS were first in performance.

When power demands increased and a new 4 cylinder, 300 H.P. engine was installed, it naturally was started up on SOLNUS OILS. The results of the first 9 months run—written in the power house log—tell a startling story. For every gallon of SOLNUS OILS consumed, an average of 5,002 hours of horsepower were produced! Not the slightest trouble has been encountered, and the diesel manufacturer's engineer reports no signs of wear and almost complete absence of carbon deposits.

That's a mighty high P-Q* (Performance Quota). How close does the record of your diesels approach it? Why not take advantage of the outstanding qualities of SOLNUS OILS, the modern diesel oils that are

- **WHOLLY DISTILLED**
- **NEUTRAL IN ACIDITY**
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Call in a SUN "Doctor of Industry"—a diesel lubrication expert—for specific recommendations. Write SUN OIL COMPANY, Phila.

Performance Quota

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SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

pumps have a peculiar drooping head-capacity characteristic curve, since this curve also passes through 250 gpm and 400 ft. The only other possible explanation is that the pump never did, or at least does not now meet its guaranteed design conditions.

FBP should not expect to deliver much more than 465 gpm through this system until and unless he decides to increase the size of piping.

Harrison, N. J. I J KARASSIK

Compare Pump Curves

FROM THE INFORMATION GIVEN, it would appear that the pumps have different pumping characteristics. That is, the impellers of one pump may have a flat operating curve while the other may have a steep curve. If such is the case the impellers with the steep curve will throttle the capacity of the pump with the flat curve. This would result in a capacity drop when both units are operating in parallel.

In order to prove this he should place first one then the other pump on the line, allow it to operate a few minutes, then close the discharge valve, and take a pressure gage reading between the closed valve and the pump.

The readings obtained are known as the shutoff pressures. If these readings do not agree, the machine with the higher pressure will curtail the delivery of the other unit when in parallel.

As a further check he should obtain and compare characteristic curves of the units from the manufacturers. If dissimilar, a new impeller should be purchased for one unit to match the characteristics of the other pump.

Seattle, Wash. J Q OSBORNE

Pipe May Be Scaled

THE REASONS for FBP's pump trouble are shown by the following computation. Static Head = 273 — 10 (Suction Lift) = 263 ft. Velocity + Friction Head = Total Head — Static Head.

1. 150 psi = 346.5 ft.
   346.5 — 263 = 83.5 ft velocity and friction head at 330 gpm.
2. 170 psi = 392.7 ft.
   392.7 — 263 = 129.7 ft velocity and friction head at 450 gpm.
3. Pressure drop across check valve at 330 gpm = 25 ft.

Total Vel & Fr Hd = 83.5 ft Vel & Fr Hd in 6-in. Pipe = 83.5 — 25 = 58.5 ft. By Hazen & Williams Formula. loss per 100 ft = 1.5 ft (330 gpm). Length of 6-in. pipe $\frac{58.5}{1.5}$ = 3900 ft.

4. Pressure drop across each valve at 450 gpm = 22.45 ft.

Total Vel & Fr Hd = 129.7 ft. Vel & Fr Hd in 6-in. pipe = 129.7 — 22.45 = 107.25 ft. By Hazen & Williams Formula, loss per 100 ft = 2.75 ft. (450 gpm). Length of 6-in. pipe = $\frac{107.25}{2.75}$ = 3900 ft.

Since a pipeline 3900 ft long does not seem to be appropriate for an overhead tank, it is apparent that excessive velocity and friction head loss is caused by some restriction. The pipe may be badly rusted or scaled, or what is more probable, a partly closed valve may be either in the line or at its outlet to the overhead tank. When such restriction is found and corrected it will be possible to operate both pumps at one time at rated capacity.

Newark, N. J. JULIUS BRODSKY

Check Motor Feeders

PARALLEL OPERATION of centrifugal pumps discharging into the same pipe often exhibits peculiar symptoms, and always results in waste of power.

In such installations as mentioned by FBP it is essential to maintain a stable head capacity curve of the pumps; otherwise the total capacity will be unevenly divided between them, and sometimes one or the other pump actually may cease to deliver.

Since in many instances such installations have not been designed for parallel operation, I should like to suggest a check on the feeder for the two pump motors, which should be adequate for a total of 100 hp.

Schenectady, N. Y. CARL BACHMANN

Reduced Capacity Caused By Low Motor Speed

FBP IS APPARENTLY DISAPPOINTED because he cannot get 660 gpm with his two pumps when one will give 330 gpm. With one pump delivering 330 gpm and 150 psi the head reaches 346 ft. This is below the rated head of his pump, 400 ft and the discharge is 80 gpm above the rated capacity of 250 gpm. This would be expected. With two pumps running the head increases to 170 psi or 392 ft only eight feet below the rated head. The discharge is 25 gpm less than the rated design capacity of each pump.

The pumps may be slightly worn in the sealing rings and leaking between the high- and low-pressure sides, and not delivering full pressure for this reason. As the rated capacity of the pumps could be handled with a 36-hp motor each, it is unlikely that 50-hp motors would be applied. It would seem that 40-hp motors would have been used. Have the motors been changed? It might be that low speed in the motors causes the reduced capacity. Only a very small reduction would be necessary to make the difference in capacity noted.

Albuquerque, N. M. E A ROBERTS

Increase Header Size

FBP'S TROUBLE SEEMS TO BE that the 6-in. header is not large enough to handle the increased friction head caused by the output of both pumps operating in parallel.

Increasing the size of discharge pipe on these pumps would reduce friction head causing considerable increase in the pressure head, hence, the rate of discharge. Apparently the discharge pipe on these pumps was not designed for parallel operation.

New York, N. Y. ANTHONY GREER

Pumps Are Delivering Correct Capacity

FBP'S TROUBLE SEEMS to be his misconception of the expected performance of two units when operated in parallel. From the data given, a system-head curve can be plotted. The pumps must operate against a static head of 263 ft. The units in parallel should deliver 500 gpm at 400 ft, providing the system friction curve is such as to permit operation at this point.

The reduction in capacity is caused by the increased friction drop at the larger capacities. In order to get more capacity out of the two units in parallel, it would be necessary to increase the size of the discharge piping and thus change the system-head curve. The capacity obtained with larger piping would depend entirely on the slope of the system curve and its intersection with the performance curve for the two units operating in parallel.

Another point to consider would be the poor-operating point for the pumps when operating alone for the new system conditions. They would then operate to the right of the design point with a very poor efficiency. Obviously, the

(*Continued on page* 124)

HE'S BEEN ON THIS JOB FOR

Seven years

Photographs taken in Nalco Laboratories, Chicago, Illinois

SOMETIMES we almost forget he is there. He is carrying out some research we are not ready to talk about yet, but it is bearing fruit. It is contributing constantly to one of the toughest known boiler feedwater treatment problems. It may even point the way to some changes in boilers themselves.

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most economical setup should be the one selected. The cost of the larger piping plus the increased power cost when operating the units singly might offset the more practical advantages of obtaining more capacity from the two units operating in parallel.

When the system head curve slopes sharply more capacity can be obtained by operating units in series rather than parallel. Each installation should have the system head curve plotted against the pump performance curve, and the expected capacity can be readily determined when operating a number of pumps in parallel or series. The pumps are delivering just about the correct capacity when operating in parallel.

East Orange, N. J. R C McDonald

Install Separate Discharge Lines

From the information supplied by FBP he expects to get double the amount when operating two pumps in parallel. Parallel operation supplying additional water creates more friction, and when this is encountered, reduced volume discharge results.

To increase the discharge volume he could increase the Y-connection from 4 to 6 in. and cut down resistance, but for maximum discharge the two pumps should have separate discharge lines.

With this arrangement a bypass could be installed so that if a breakdown occurred in one of the lines the discharge from that pump could be bypassed into the other discharge line. I believe it would be a good policy to install 6-in. lines from pump direct to the overhead storage tank.

Philadelphia, Pa. W T Mullen

Check Valves Not To Blame

FBP states that his two centrifugal pumps do not deliver twice the quantity below rated head that one pump does when running alone.

Head losses can be calculated as the square of the liquid velocity in the pipe. When two pumps begin to operate, the flow will be doubled, increasing the head losses four times. In the problem the head in feet to the cold water tank is 273-ft. The static head amounts to about 265.5 ft and losses in pipe friction and fittings 7.5 ft. Then if we proceed to double the flow in the pipeline, we still maintain the 265.5-ft static head, but pipe friction losses increase to $7.5 \times 4 = 30$-ft head, making the total head $265.5 + 30 = 295.5$ ft.

At their rated capacity the pumps cannot discharge against this head; therefore they drop to a lower discharge rate. This can be corrected by installing a larger pipe because the check valves are not causing the trouble.

With two pumps operating in parallel and discharging into the same line, their motors should have practically the same speed characteristics, so that neither of the pumps will develop any greater speed than the other.

The pumps should also be taken apart and examined to see if repairs are needed on, for instance a worn impeller; this will depend on the length of time they have been in operation.

(*Continued on page* 126)

Discharge Line Throttled

The data given by FBP allow three points on the system head curve to be obtained, namely: zero flow, 263 ft; 330 gpm, 337.2 ft; and 450 gpm, 383 ft. In each case velocity head correction assumes a 5-in. suction, 4-in. discharge. This curve is shown as "System Head—One Pump" on the accompanying graph. Because at 450 gpm each pump discharges 225 gpm, two points on the system-head curve corresponding to two pumps in service can be obtained, namely: zero flow, 263 ft; 225 gpm, 383 ft. This curve is marked "System Head—Two Pumps".

These two system-head curves give two points on the pump characteristic head curve (*B*) and allow it to be estimated as shown.

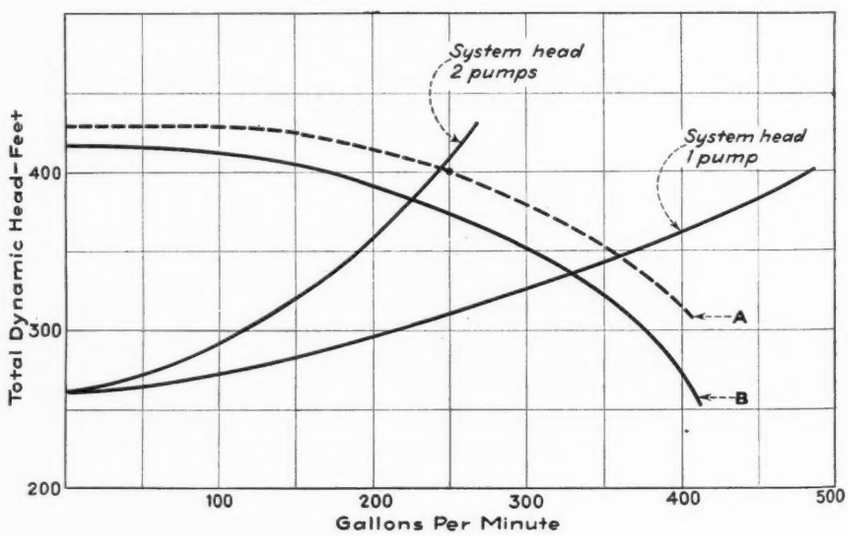
The intersections of the system head and pump head curves determine the pumping rate for any given condition. From the curves it will be seen that operation is normal with the flow from one pump falling from 330 gpm when operating alone to 225 gpm in parallel. This is because of the system head for 450 gpm total flow being applied to each pump rate of 225 gpm when both pumps are operating.

The rated pump head curve (*A*) has been estimated, and is shown by the dotted line. The variation of actual from rated head could be caused by the pump running 2% slow or by wear.

Restrictions or faulty fittings outside the pumps can alter the system-head curves and therefore the pumping rate, but cannot alter the pump head curve which depends only on pump speed and internal mechanical conditions.

The friction loss in the system is very high, namely in excess of 31% at 450 gpm. If the discharge line at the tank is open, the piping should be checked and altered to reduce this value to less than 15%. With a 6-in. discharge line, open at the tank, the system head at 450 gpm should not exceed 280 ft. The actual system head indicates a discharge line of less than 4 in. equivalent diameter or some throttling condition not specified. If throttling can be avoided with a 6-in. discharge pipe, each pump can supply over 400 gpm without overloading the 50-hp driving motor.

St John, N. B. C G Clark



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OIL IS *Ammunition* - USE IT WISELY

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Capacity of a centrifugal pump varies directly with the impeller diameter, and the head varies as the square of the impeller diameter. With a worn impeller, the capacity of a pump drops.

Fairview, N. J. M N GOZDENOVICH

Engine Taps Badly at All Loads

Answers to Oct Question 2

The Question

MY 4-CYL ANGLE *steam engine has a tapping sound in one cylinder at all loads. The noise appears to come from the 12x14-in. vertical cylinder supplied with 80-psi steam and operating against 7-psi backpressure. The diagram was taken with a 40-lb spring at an engine speed of 304 rpm.*

This particular cylinder was recently bored and rebushed. End clearance is ¼ in. I have checked all bearings, piston, piston rod and crosshead and cannot find any trouble that would cause this noise. Can POWER *readers advise me what adjustments are needed?—GEB*

Exhaust Lines Improperly Drained

GEB'S QUESTION would imply that the tapping has appeared only since the cylinder was rebored. This is quite likely as the card clearly shows water in the cylinder which previously was not noticeable, because the loose-fitting piston allowed the moisture to pass.

The high peak at the crank end reaches 83 psi as the moisture is trapped in the clearance space and forced back against the incoming steam pressure of 80 psi (see sketch).

As soon as the piston starts its stroke the pressure drops to 50 psi because of condensation. The point is then reached where sufficient steam has entered to re-evaporate partially this moisture and the pressure reaches 75 psi.

Partial condensation again takes place, this being more noticeable in the crank end because more moisture tends to gather in the bottom of the cylinder than the top.

The mep of the crank end shows 38.4 psi and that of the head end 37.2 psi, giving a fairly even balance. The eccentric should not be changed.

The remedy, however, involves adding sufficient lap to the exhaust edges of the valve so that the exhaust opening will be delayed long enough to maintain a slightly higher pressure at the beginning of the return stroke. This will tend to carry the moisture into the exhaust instead of having it trapped in the cylinder. The cards will then show a rounded effect on the toe, as indicated by the dotted lines. Before making any changes GEB should take another set of cards with the cylinder drains barely cracked open to drain moisture and compare them with previous cards.

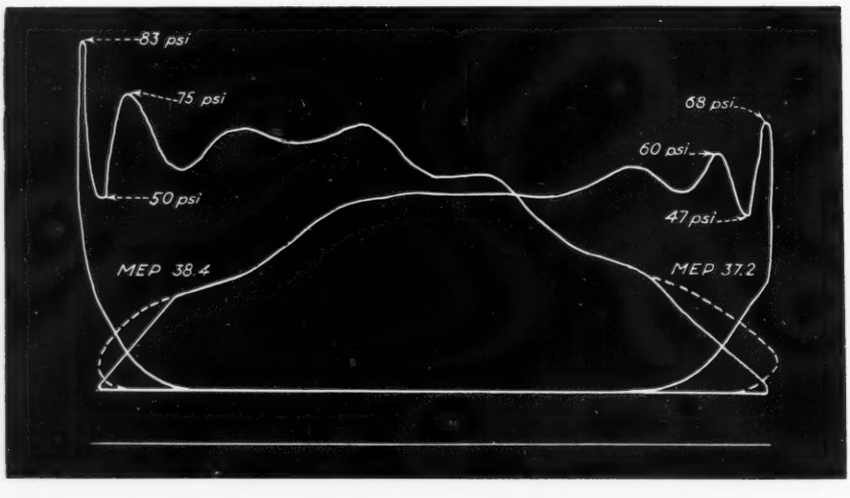
Kearny, N. J. GEORGE MCNALLY

Valve Spring Weakened

ACCORDING to GEB's indicator card the valves are not set correctly because cutoff occurs much later on the crank end than on the head end and compression is also too high.

With vertical cylinders, it is more difficult to hold the valve to its seat. The valve spring may be broken or its tension may be too weak to hold the valve. This would cause the tapping sound when the valve is raised.

Rainelle, W. Va. B L WHISMAN



High Moisture Content

GEB DOES NOT SPECIFY the kind of valve or governor used on this engine. The rise in the expansion lines and the hump on the head-end compression curve indicates a leaking valve. It does not seem to me that ¼-in. clearance on an engine running at 304 rpm is sufficient. This is equal to a clearance volume of 3.5% of the total piston displacement. If the steam is wet, which it undoubtedly is at that initial pressure, I think that partly causes the tapping.

Wavy lines on the diagram are formed by inertia of the indicator piston. However some discrepancies occur in the valve setting, such as a greater compression and a lesser amount of lead on the head end, which if remedied would improve the engine operation. The cutoff is also earlier on the head end than on the crank end.

The backpressure line seems to be too perfect and the points of release too defined to be natural. I believe that some obstruction or friction prevented the indicator piston from completing its downward stroke.

I suggest that GEB check the moisture content of the steam to see if water is not causing the tapping noise.

Duluth, Minn. E R WEBBER

Check Crosshead and Guide Clearance

GEB DOES NOT state if the tapping sound was in evidence before the reboring and rebushing job was done on the engine cylinder.

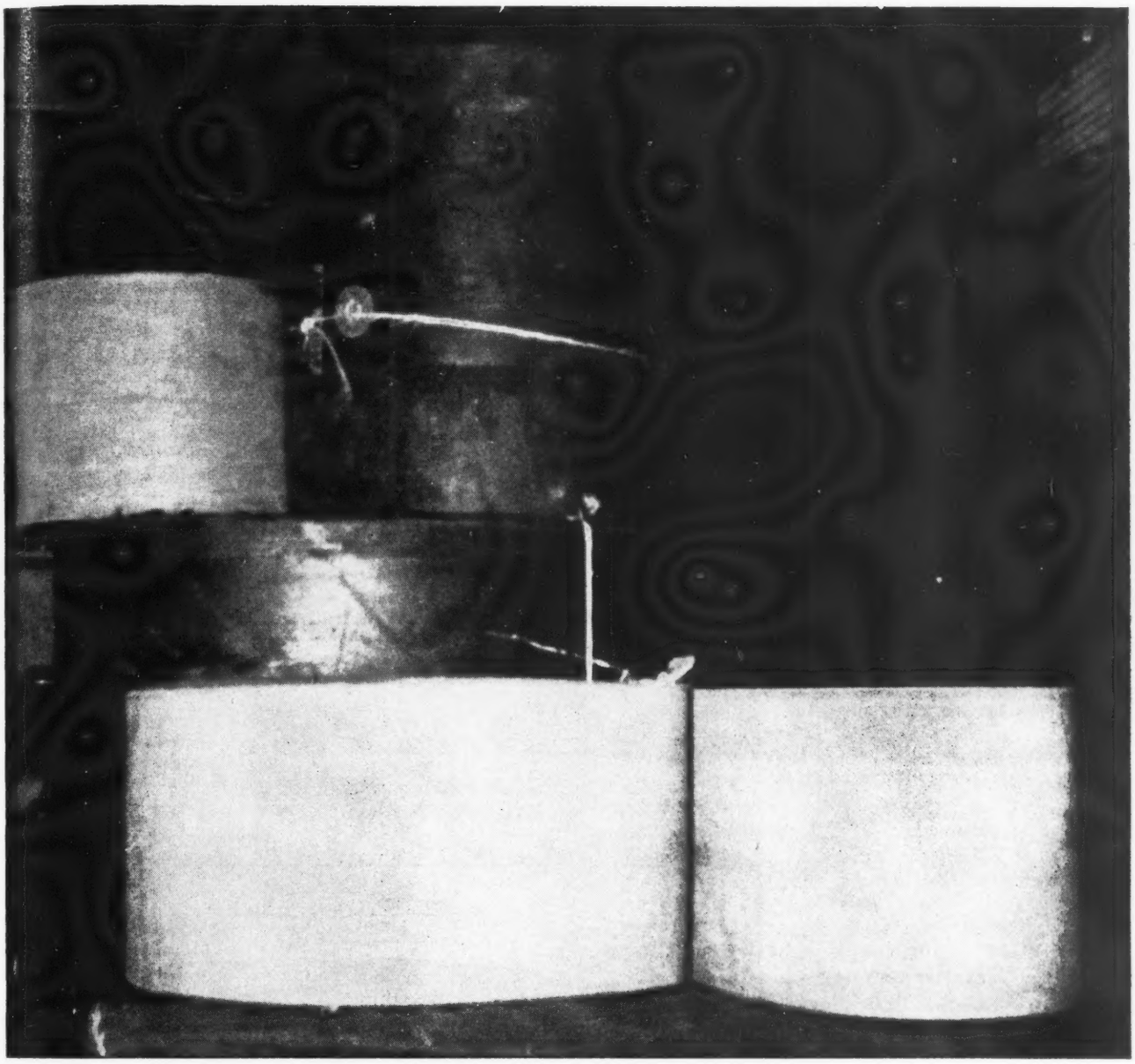
If the cylinder was rebored slightly out of alignment with the original bore it would cause the crosshead shoes to ride unevenly on the guides and set up a tapping sound which would appear to come from the cylinder. The unequal compression, as shown on the indicator diagram, would tend to accentuate this tapping sound.

The card also shows late admission and point of cutoff on both head and crank end. Steam admission should be set earlier on both ends, and unequal compression should be corrected. The wavy expansion line is caused by a faulty indicator.

I suggest that GEB use a set of feelers and check the clearance between crosshead shoes and guides.

New York, N. Y. JAMES DALY

(*Continued on page* 144)



Found! Rubber in a coal mine

Another B. F. Goodrich suggestion to save rubber

SAVING rubber today is just like finding it — and rubber can be saved in every plant where belts are used.

Take the case of a West Virginia coal mine. They had three old and worn belts, containing about 44 pounds of rubber, which ordinarily would have been thrown away. The B. F. Goodrich distributor suggested salvage of these belts for use on other drives — and here is what they made.

Original Belts	*Made Into*
2—10-in. 7 ply	1—3½-in. 5 ply—open end
1—12-in. 7 ply	1—4-in. 5 ply—open end
	1—3½-in. 5 ply—endless
	2—6-in. 5 ply—endless
	1—8-in. 5 ply—endless

Out of the original discarded belts came 6 new serviceable belts (80% or 35 pounds of the original rubber was salvaged).

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Before you discard any old belting call your nearest B. F. Goodrich distributor for his advice. (Write us if you don't know his address.) Also write us for a series of folders filled with helpful tips on how to conserve all the industrial rubber products you have. For users of conveyor belts, we will also send on request a special illustrated Belt Maintenance Manual. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F. Goodrich

FIRST IN RUBBER

ARGUMENT CORNER

Sloppy Operation

MY COMMENTS REFER to the article "Sloppy Operation" in April POWER and Mr Gorrie's comeback in August. There is much to be said on both sides. The consulting engineer can point to failings of the operator. For example, the operator is often not able to present a convincing case for needed new equipment or repairs.

Many operating engineers know how to keep a plant going but aren't good when it comes to improving operating methods or making correct analyses of investment, amortization, etc.

Many times I have been asked to help men about to take an examination for stationary engineer. At such times they like to brush up with "question and answer" books. The trouble is the man often memorizes the answer but doesn't know *why* it is right—thereby riding for a fall when some emergency arises in his plant.

Again it often happens that some young man asks me how he can get ahead in the operating field. I tell him to investigate correspondence courses, vocational schools and textbooks. I have seen many men start these studies but very few finish them.

One of the serious errors of consulting engineers, as pointed out by Mr Gorrie, is overloading equipment. Many a boiler is being burned up today with no standby. The unit cannot be taken out of service for cleaning and repair of baffles because the plant was shaved too thin in the original specifications.

I am sorry to say that I have felt as Mr Gorrie feels toward some consulting engineers, but I have found that marshalling the facts and standing ground always gets proper results.

My advice to engineers (and it is 35 years since I left school) is to keep on your toes by taking one of the many courses offered—the equivalent of anything a college has to offer. You may not get a degree, but why care as long as you can prove the merit of your own idea and show the other fellow where he is wrong—if he is.

Buffalo, N. Y. ALON CARTER
Chief Engineer, Member Natl. Bd. of Boiler and Pressure Vessel Inspectors

Air Storage Capacity

IN A RECENT ARTICLE in POWER, an illustration showed a battery of tanks used as a cushioning or accumulator element on an air line.

The idea is a good one, there are some details I call to the attention of any engineer who may feel the need of some extra capacity and means of preventing line pressure drop when aid tools are in full use.

From the picture, it appears the tanks are of the pin-riveted-brazed. longitudinal joint construction, commonly found in use with domestic hot-water installations. The tanks are mounted with the heads taking pressure on the convex side at lower end. Such tanks are not suitable for air pressure, subjected as they are to pulsations and pressure changes of the compressor piston and output drop.

It is impossible to drain all the sludge that will accumulate in the tank when the convex head is at lower end—a drain to handle the water and oil emulsion would have to be at the point where the head and shell meet—and corrosion will weaken the shell and head at this point. There is no way of inspecting the internal surfaces. Contrary to a common claim that a tank is "blown out daily" no tank of the type shown and so installed can be drained under pressure. The air will produce a vortex, which holds the sludge back and the only way such a tank can be drained is by welding in a nipple in the center of the concave head, and standing the tank with the "bumped out" head down, or placing the tank horizontally on the wall, with one end slightly lower than the other containing a drain. (It is apparent the nipple must not project into the tank, hence the welded nipple.)

The writer does not give the National Board rule for dished heads but if the heads are the same thickness and the same radius of dish, the convex head is allowed 60% of the pressure for the concave head.

$$\text{(thickness) } t = \frac{8.33 \times P \times L}{2 \times TS}$$

$P = SWP$ L = Radius to which head is dished

TS = Tensile Strength

As a boiler inspector, I have seen

(*Continued on page* 148)

". . . and when you get it finished—how do you know it will work?"

Instead of conveying oil, steam, gas or water, here flexible metal hose houses a parachute ripcord, protects it against mechanical injury, might save a man's life.

Using practically any workable metal, we can build flexible metal hose or tubing for anything from a simple oil can spout to a high pressure *seamless* hydraulic line that can be flexed millions of times without failing . . . a line that will give you the flexibility of garden hose, the dependability of metal and the *strength of rigid pipe.*

Could it be that some type of this hose or tubing is the "missing link" you have been looking for?

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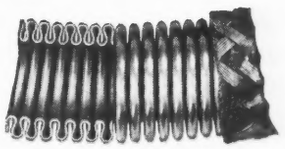
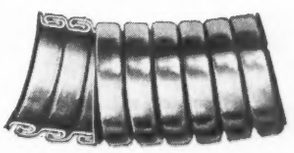


American "Seamless", no seams, welds or joints... pressure tight as the metal tube from which it is made.



American "Interlocked", most rugged type of hose... full interlocked joints are packed for pressure tightness.

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POWER LINES

Engineers In War Effort Keynote of Convention

The decisive role of engineers in the war effort and the contributions of engineering and industrial production to victory will dominate the program of the 63rd annual meeting of the American Society of Mechanical Engineers, at the Hotel Astor, New York, from November 30 through December 4.

"America should feel proud and encouraged by the achievements of industry and engineering in the battle to defeat the Axis," said James W Parker, of Detroit, president of the society, in announcing the program. "We can and we must play our role to the fullest measure."

Mr Parker, who is vice president and chief engineer of the Detroit Edison Company, stated that key topics at the convention will include manpower and its training for maximum production; the importance of intuitive, inventive and ingenious faculties in engineering; equipment, railroads, aviation, manufacturing processes and problems, power, management, training, industrial conservation, salvage, increasing adaptability of workers to job requirements, and many other topics of timeliness in war.

About 125 papers will be read covering the varied fields of engineering, and panel discussions and symposiums will be held, with outstanding leaders in each field presiding.

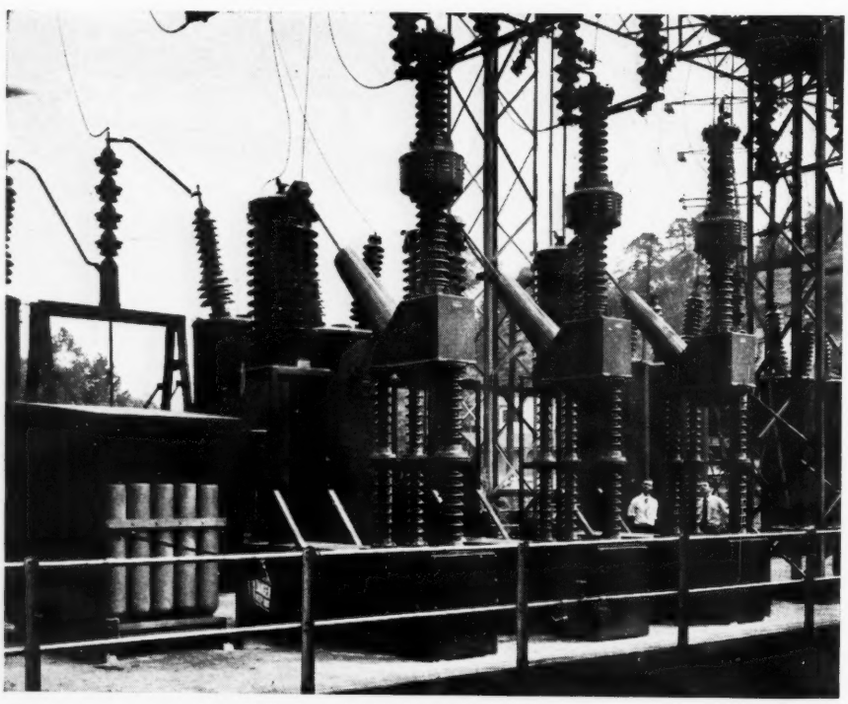
Refresher Course for Handling Wrought Iron

A unique industrial refresher course designed to increase efficiency in the handling of wrought iron and thus save metal for war has just been offered by the A M Byers Company of Pittsburgh.

The course consisting of easy-to-read charts and instructive booklets is designed for use by pipe fitters, plumbers, welders, and all other metal workers who work with wrought iron pipe or plates. It is also available for students in apprentice or "up-grading" training courses.

To date, four large wall-type instruction charts and four booklets have been made available. The charts cover the subjects of pipe threading, pipe bending, plate bending and flame cutting and welding. The booklets augment the charts and cover the same subjects.

NEW BREAKER OPERATED BY COMPRESSED AIR



The 138 kv compressed air circuit breaker with an interrupting capacity of 1,500,000 kva has been recently placed in service by the West Penn Power Company. This experimental compressed air breaker, the largest ever built by the Westinghouse Electric and Manufacturing Company, contains no oil; the interruption takes place in an enclosed arcing chamber filled with air. An automatically controlled air compressor maintains a pressure of 1000 psi in the storage tanks. This pressure is reduced to 350 psi at each pole.

MEETINGS

American Society of Refrigerating Engineers—*Annual Meeting, December 1 and 2, Hotel Commodore, New York, N. Y.*

15th National Exposition of Power and Mechanical Engineering — *Madison Square Garden, New York, N. Y., November 30 to December 5, 1942.*

American Society of Mechanical Engineers—*63rd Annual Meeting, November 30–December 4, 1942, Hotel Astor, New York, N. Y.*

American Society of Heating and Ventilating Engineers—*Annual Meeting, January 20–21, 1943, Hotel Gibson, Cincinnati, Ohio.*

American Institute of Electrical Engineers—*National Technical Meeting, January 25–29, 1943, Engineering Societies Bldg, New York, N. Y.*

Refrigerating Engineers to Meet Dec 1 and 2

The essentiality of refrigeration in war production will be emphasized in the technical program for the 38th Annual Meeting of The American Society of Refrigerating Engineers, to be held December 1 and 2 at the Hotel Commodore in New York, N. Y. Since all members of the Society and their friends are now on strenuous wartime schedules, and in order to cooperate with Government efforts to cut unnecessary travel, the Annual Meeting has been compressed into two days rather than the 3-day session regularly scheduled in peacetime.

The convention opens Tuesday morning, December 1—technical sessions will be held in the morning and afternoon of that day and on the following morning, December 2. ASRE committee meetings will be held the evening of December 1, the entire convention being given over to necessary business, with all social features eliminated. A Welcome Luncheon honoring the speakers will be held on December 1 and an informal, brief dinner for members and friends of the Society the evening of the same day, but for the first time in many years members are not urged to bring members of their families to the convention.

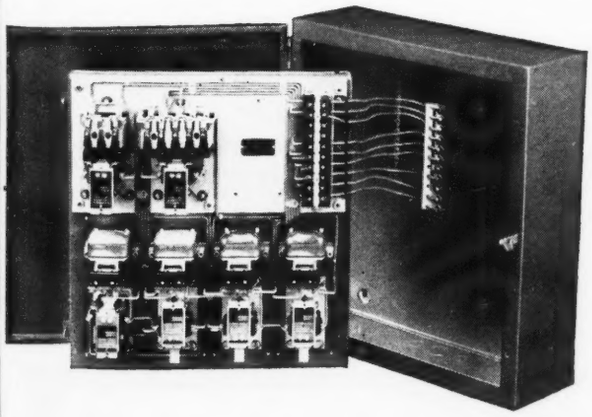
OBITUARIES

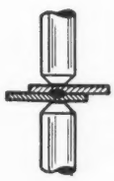
L HARRY HOWE, 59, first chief system dispatcher of the Boston Edison Co, and a past chairman of the New England System Operators Club, died at his

IS YOUR RESISTANCE WELDER *Automatically* CONTROLLED?

Safront TIMERS

- Square D builds 18 NEMA standard types of Safront weld and sequence timers. Unusual application conditions will be met with special construction from unit parts.
- Safront construction places all electrically energized parts behind a protective panel. Yet calibrated timer adjustments are completely accessible on panel front.
- Separate pneumatic timing devices, provided for each step of the welding cycle, are individually adjustable from 3 to 100 cycles, simply by turning a small knurled wheel.
- Safront interiors "swing out" to expose operating parts. A separable connector permits panel removal without disturbing external connections.



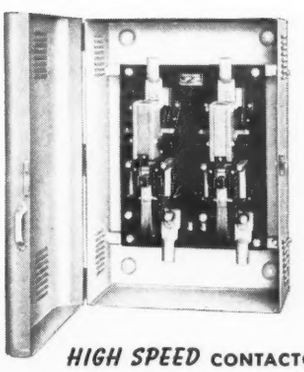


A resistance weld is made when two or more pieces of metal are clamped between copper electrodes and a high value of current is passed through them. Consistently good results depend upon application of *pressure* and *power* in a *carefully controlled sequence.*

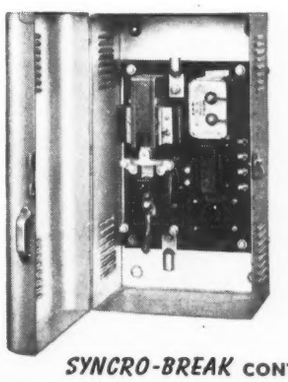
Automatic control for both pressure and power functions gives uniform welds and the highest production rates practical under existing conditions.

Square D has devoted years to the development of fully automatic control for all types of resistance welding machines.

Specify Safront Timers with Syncro-Break or High Speed contactors on your new machines. Consult our representative about the possibility of equipping old machines now in service, to improve both quality of welds and production rates.



HIGH SPEED CONTACTOR



SYNCRO-BREAK CONTACTOR

Both Syncro-Break and High Speed contactors possess unusual design features necessary for frequent making and breaking of the resistance welding transformer primary circuit.

The Syncro-Break design includes means for opening the circuit without arcing at contact tips—thus improving contact life and increasing allowable ratings. This Square D development has proved to be the solution to contactor difficulties normally experienced where operating rates are high and loads heavy.

These contactors, with Safront timers, provide fully automatic control for all types of resistance welding machines.

SQUARE D COMPANY
DETROIT - MILWAUKEE - LOS ANGELES
KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK
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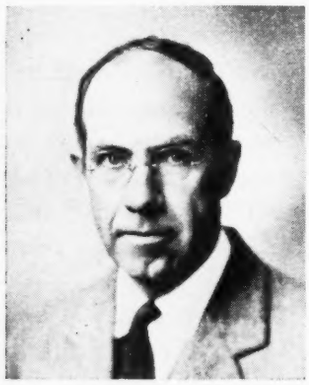
home in Arlington, Mass., on Oct 27. He was retired about two years ago.

EDWARD F DUNBAR, 75, for many years a stationary engineer at Lynn, Mass., died in that city on Oct 13.

NELSON J DARLING, manager of General Electric's West Lynn and River Works, died Oct 26 at his Beach Bluffs, Mass., home. He was 58 years of age. Mr Darling joined the General Electric Co following his graduation from Cornell University in 1907. In 1919 Mr Darling was loaned to the Dodge & Day Co, and went to the Panama Canal Zone



to assist in the installation of electrical apparatus. After returning to the General Electric Co in December of that year he served in the company's railroad engineering department at Schenectady until his transfer to the Erie, Pa., plant. In November, 1918, he was appointed assistant manager of the Erie plant, and in 1922 manager of the River Works at Lynn, Mass. In September, 1935, Mr Darling was made manager of General Electric Lynn Works, in addition to his duties at the River Works.

PERSONALS

E J HAMMERLY, salesman in the Philadelphia district of the industrial products sales division of the B F Goodrich Co, completed thirty years of service with his organization in October. Hammerly started work with B F Goodrich on Oct. 14, 1912, as a clerk in the Akron headquarters offices, and four years later began his sales career. He has been on the staff of the industrial products sales division in the Philadelphia district since 1917.

EARL WESSELHOFF has been appointed manager of the Boston branch of the Morse Chain Co, Ithaca, N. Y., to succeed C L Pratt, Jr. Mr Wesselhoff goes to Boston from the Detroit plant, where his first association started 22 years ago as automotive timing chain drive engineer. In his new post, Mr Wesselhoff will make his headquarters in Boston.

GEORGE B SHAW has been named sales engineer of the Keystone Carbon Co, St. Mary's, Pa. Mr Shaw is a graduate of St Francis College.

GEORGE E CLIFFORD was elected a vice-president of the National Supply Co, Pittsburgh, Pa., on Oct 19, 1942. Mr Clifford will assume his present responsibilities in addition to being vice-president in charge of sales for Spang-Chalfant, Inc.

JOHN B JENKINS has been appointed manager of the hydraulic division of the Twin Disc Clutch Co, Racine, Wis. For the last eight years Mr Jenkins has been in charge of the company's factory branches at St Louis, Tulsa and Dallas.

CHARLES G MAIER, noted research metallurgist for nearly twenty years, associated with the U. S. Bureau of Mines, has been named to the supervisory staff of Battelle Memorial Institute, Columbus, Ohio. Mr Maier will direct and correlate an enlarged program of fundamental research and will serve as advisor and consultant to the Institute's war research for the government and industry. Before joining the Battelle staff, Mr Maier was supervising research engineer of the Pacific Experiment Station, U. S. Bureau of Mines, at Berkeley, Calif., where he had been in charge of the Bureau's fundamental research program.

FENCE ENLISTS

Down goes an ornamental metal fence from the roof of the Cambridge (Mass.) Electric Light Company's steam plant to serve the scrap campaign by yielding 17,465 pounds of useful material for war purposes. Gustave Brolen, chief engineer, stands at the left, while Raymond J Whitty wields the blow torch.

MARK A DEFIBAUGH has been named superintendent and works manager in charge of all manufacturing of the

(*Continued on page* 164)

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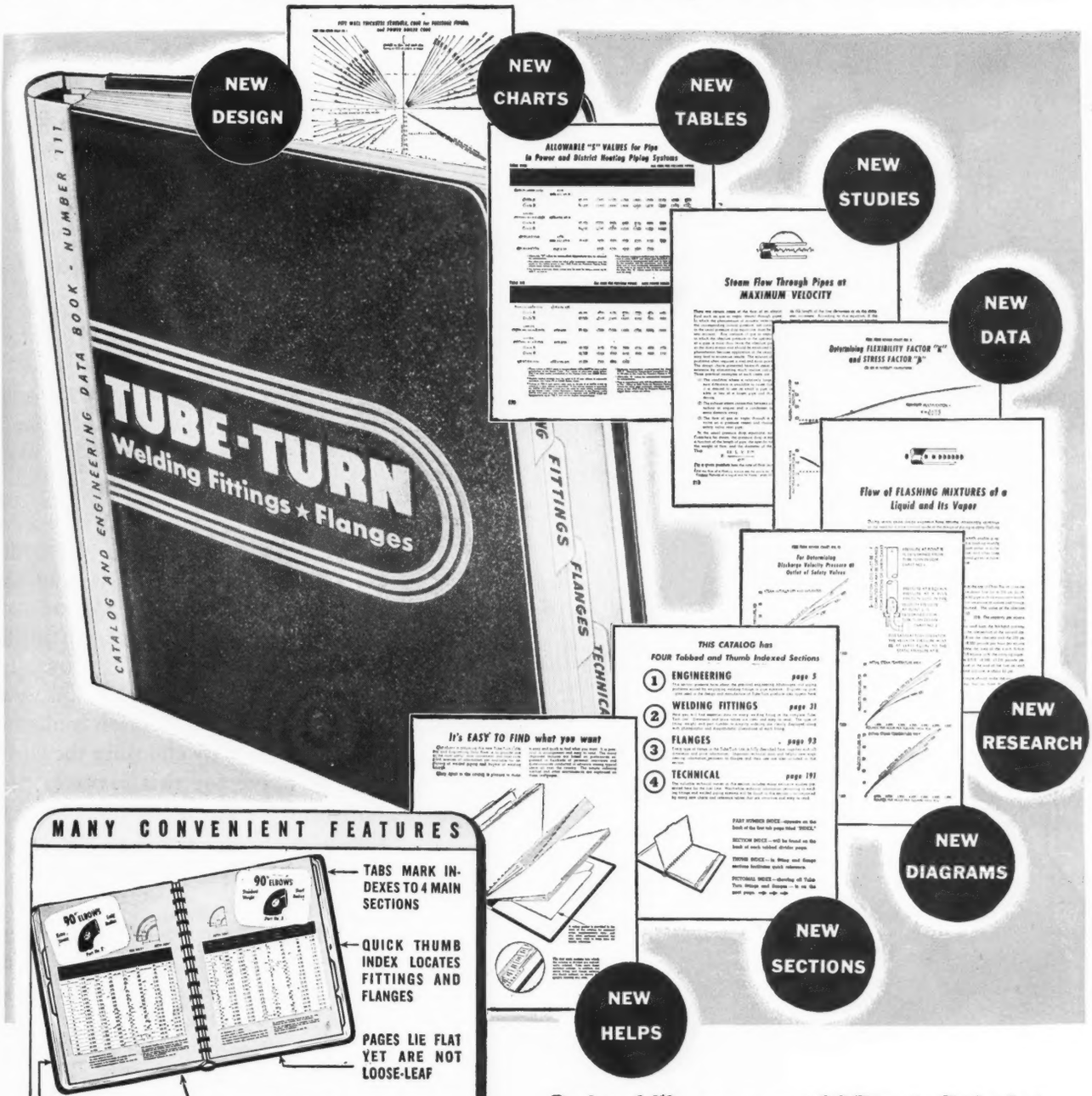
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Flow of FLASHING MIXTURES of a Liquid and Its Vapor
For Determining Discharge Velocity Pressure at Outlet of Safety Valves
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3 FLANGES page 93
4 TECHNICAL page 191
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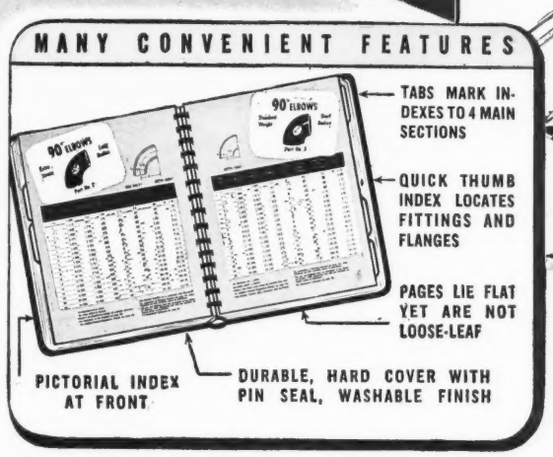
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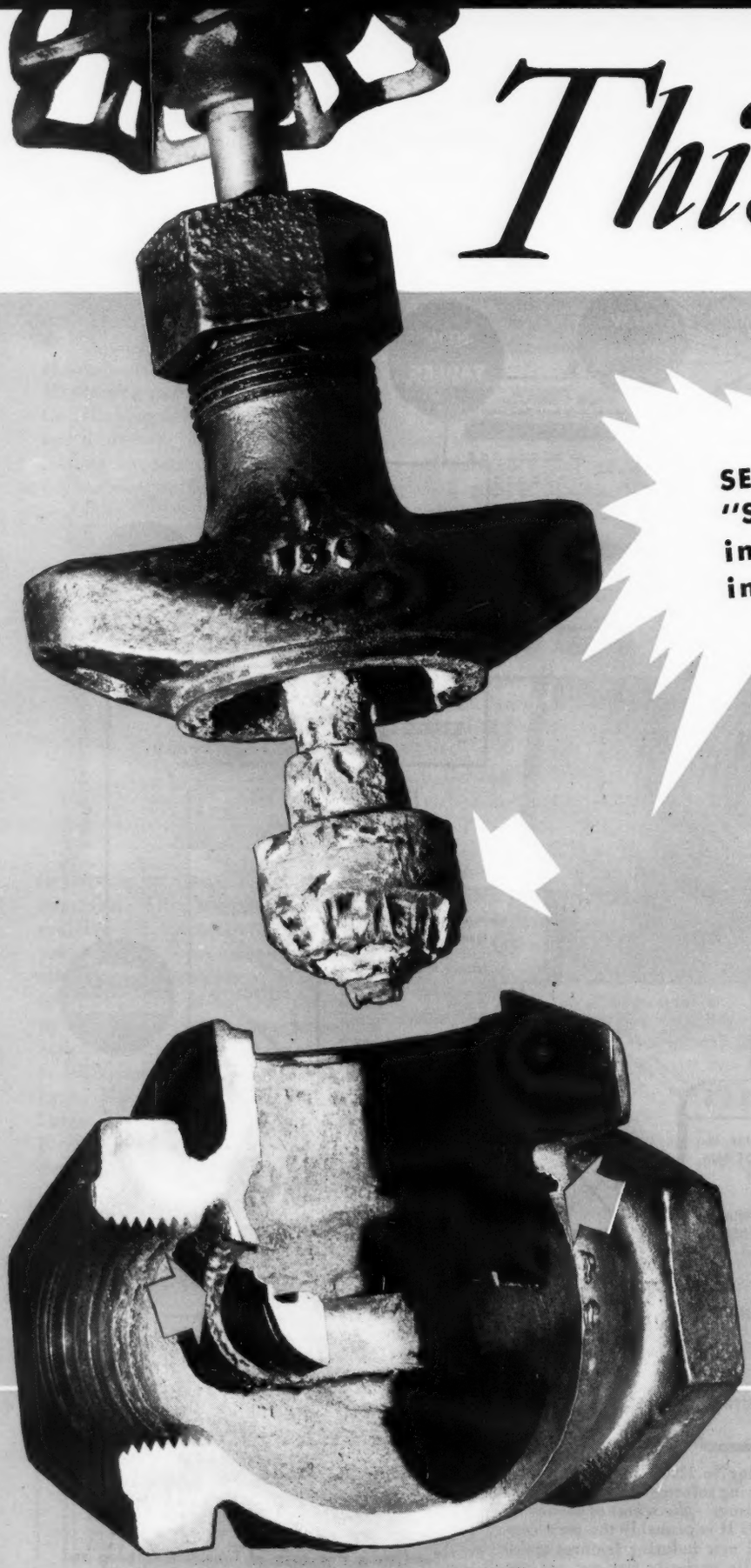
This Valve



SENTENCED TO DEATH by "Sand Blast" effect when incorrectly chosen and installed . . . . . .

THIS Iron Body Globe Valve served only a few months. It was riddled by a fusillade of dirt, grit, and scale carried in the water. Throttling accelerated the flow velocity and intensified the "sand blast" effect. The seat, disc, and body were damaged beyond repair.

This needless destruction could have been prevented by choosing the correct type of valve for this service. Since replacements can be obtained only for the most critical needs in the present emergency, such valve waste must be avoided.

Note the mutilation of the steel bevel disc and integral seat by the continuous wire drawing effect of the abrasive jet . . . also, the complete perforation of the body where the flow impinged.

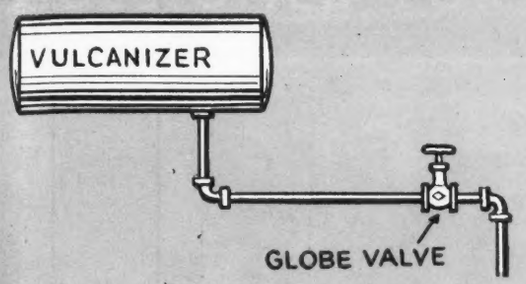
Army-Navy "E" Pennant awarded to Jenkins Bros. for high achievement in the production of war equipment.

Jenkins Bros., 80 White Street, New York, N. Y.; Bridgeport, Conn.; Atlanta, Ga.; Boston, Mass.; Philadelphia, Pa.; Chicago, Ill. Jenkins Bros., Limited, Montreal; London, England.

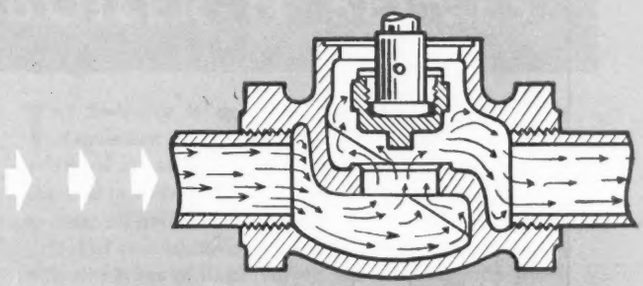
JENKINS VALVES

...never had a chance!

WRONG INSTALLATIONS may cause valve failure and production slow-downs

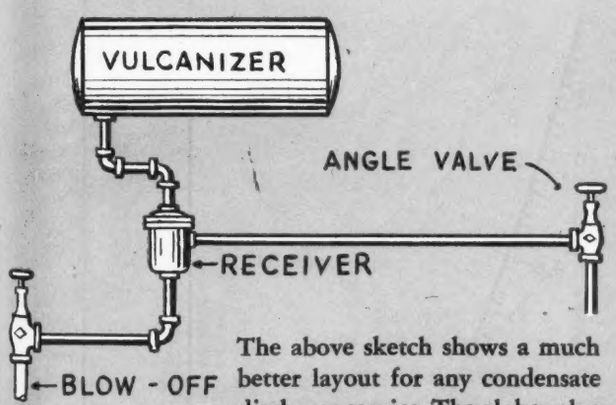


The above sketch shows how the valve was installed in a condensate line from a vulcanizer, carrying about 90 pounds steam pressure.

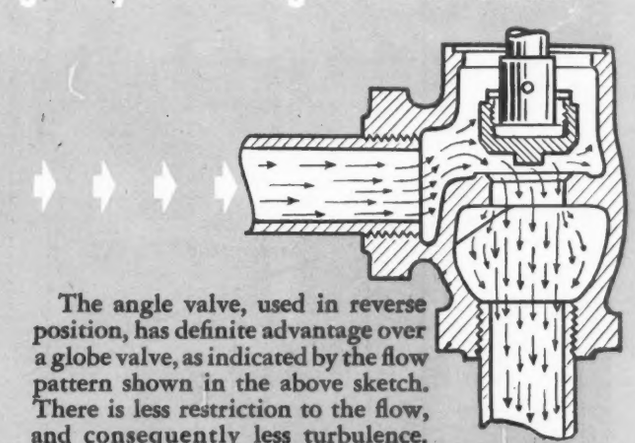


This sketch shows how the flow pattern of the liquid created excessive turbulence and subjected all parts of the valve to destructive attack.

RIGHT INSTALLATIONS keep "fluid highways" serving the war effort



The above sketch shows a much better layout for any condensate discharge service. The globe valve is replaced by an angle valve, and a sediment trap and blow-off valve are added. The sediment trap collects the abrasive solids, to prevent them from passing through the valve. The blow-off valve allows an occasional blow-down to remove accumulated solids.



The angle valve, used in reverse position, has definite advantage over a globe valve, as indicated by the flow pattern shown in the above sketch. There is less restriction to the flow, and consequently less turbulence. Discharge through the seat is almost directly into the pipe-line, the seat acting as a funnel permitting straight-down flow. Wear is reduced and service life is extended.

The angle valve is especially recommended for severe conditions in many classes of service, such as continuous blow-downs, steam reducers, and soot blowers.

Since valve-failure often means serious interruptions in our war production, and valve destruction wastes scarce metals, it is management's vital responsibility to keep valves operating efficiently.

Most valve trouble can be prevented before it starts . . . by frequent, thorough inspection . . . by repair or replacement of worn parts in time to prevent valves from destroying themselves. New maintenance workers should be taught to detect the first signs of trouble . . . to correct it without delay. Valves for approved new construction should be carefully selected, and properly installed.

Consult Jenkins Engineers for assistance in improving your valve conservation.

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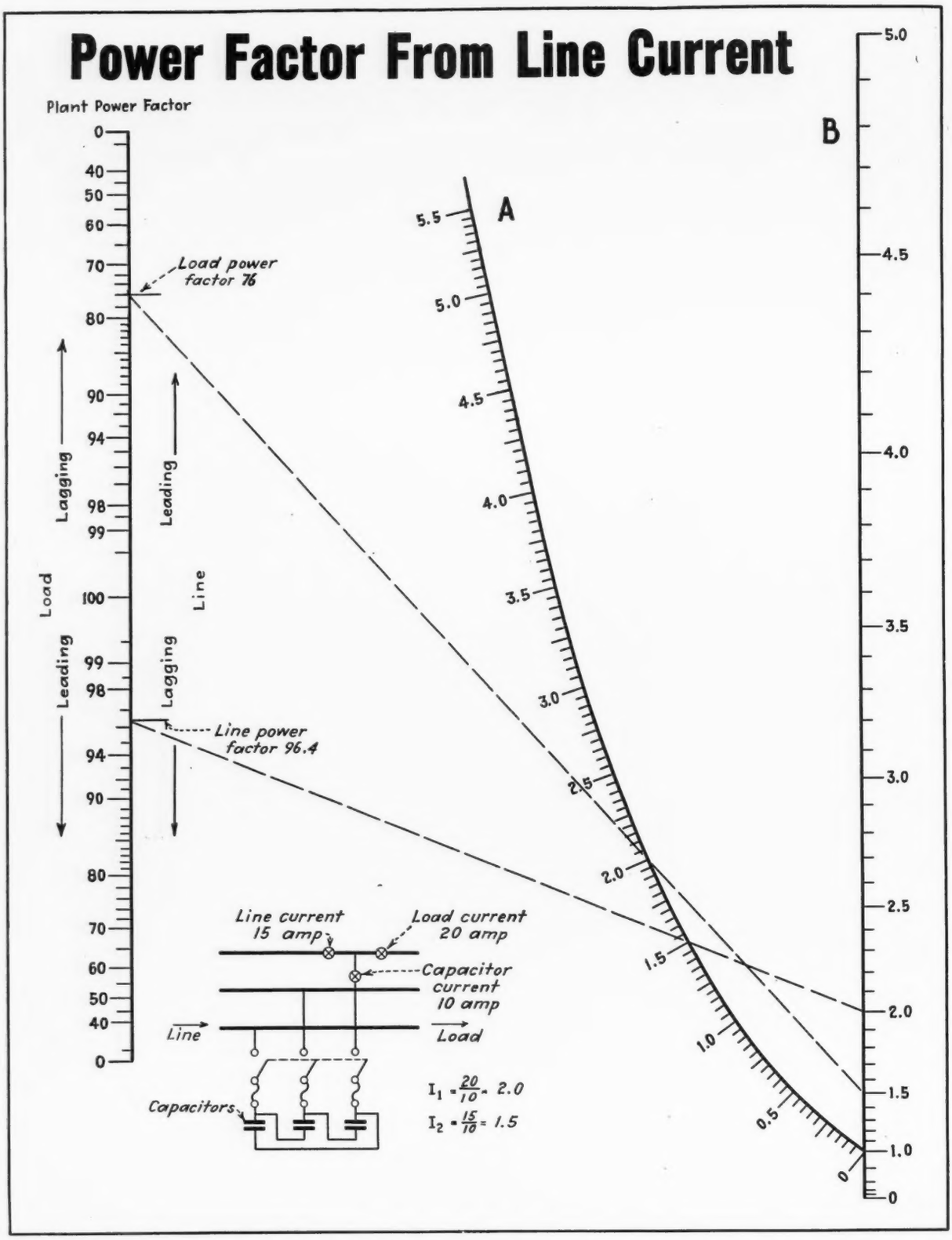
Power Factor From Line Current



▶ IMPROVEMENT in power factor after installation of capacitors can readily be determined from ammeter measurements of line current, load current and capacitor current.

Divide *load current* by *capacitor current* to get ratio I_1. Divide *line current* by *capacitor current* to get ratio I_2. To obtain load power factor, line up I_1 on scale *A* with I_2 on scale *B* and read power factor on scale at left of chart. To obtain line power factor, interchange I_1 and I_2 so that they are read on scales *B* and *A* respectively and again read scale at left for leading or lagging.

For example, if 10-amp capacitors cut current from 20 amp to 15 amp per conductor, I_1 will be 2.0 and I_2 will be 1.5. Power factor has been improved from 76 lagging to 96.4 lagging.

Courtesy General Electric Co

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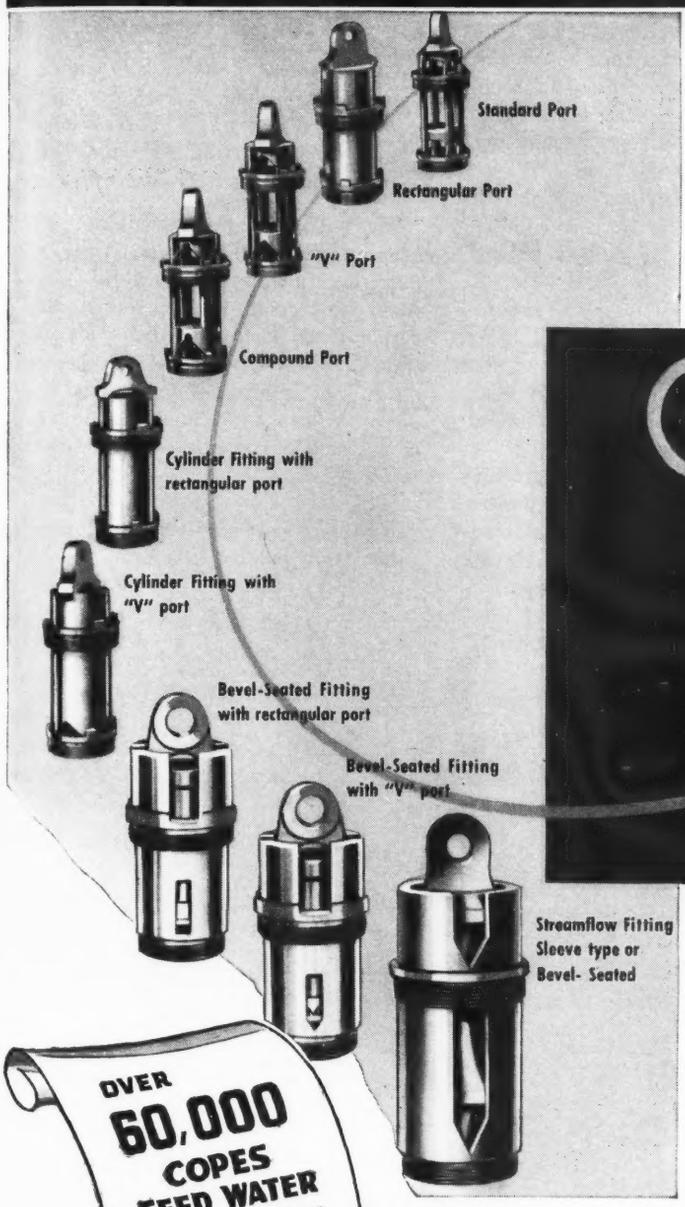
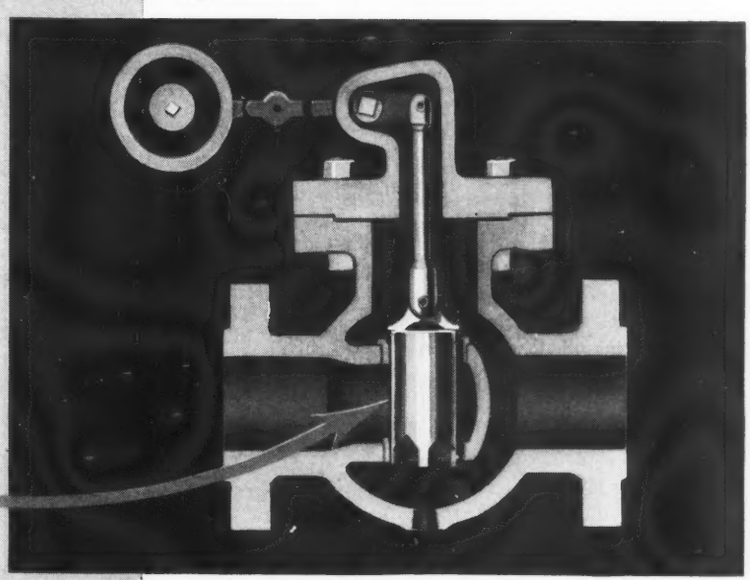
NO TWO BOILERS ALIKE

THAT'S WHY THE COPES BI-VALVE IS DESIGNED FOR THE BOILER IT SERVES



THE BI-Valve is as common to COPES Feed Water Regulation as is the familiar Thermostat. With 30 years of constant improvement and simplification, checked in over 60,000 applications, the BI-Valve is built to meet all boiler feed water requirements.

Out of several hundred exhaustive tests with as many different types of inner valves, we have learned which size of ports are necessary to give the proper imput to your boilers. They are tailored to meet specific operating conditions.



These "made to order" inner valves are one of the reasons for superior COPES performance—the closest relation between water imput and steam output—smoother charts.

Let COPES show you how to get the most out of your boilers.

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ENGINEERS' BOOKSHELF

Welding Training Manuals

GAS WELDING TRAINING MANUAL (1942). *By the staff of the Dunwoody Industrial Institute. Published by American Technical Society, Drexel Ave at 58 St, Chicago, Ill. 92 pages, 8½x11 in.; illustrated; heavy-paper binding with wire spirals. Price $1.25.*

ARC WELDING TRAINING MANUAL (1942). *By the staff of the Dunwoody Industrial Institute. Published by American Technical Society, Drexel Ave at 58th St, Chicago, Ill. 103 pages, 8½x11 in.; illustrated; heavy-paper binding with wire spirals. Price $1.25.*

These welding training units consist of 40 jobs each with an information sheet of checkup questions for the first 32 jobs. An information sheet without questions is also included with the remaining eight jobs. The plan of training and the training material outlined in these units have been developed and used by the Dunwoody Institute, the Smith Welding Company and the Commercial Gas Company, all of Minneapolis, Minn. Several pages of suggestions and helps on the use of these manuals are included with them. An instructors guide that covers more in detail the suggestions made in the manual, the organization and device for efficient shop control and methods of teaching is available, and extra sets of checkup sheet for each manual can be obtained. The material in these manuals is practical and clearly presented and should be helpful to those teaching either electric or gas welding.

Electricity

PRIVATE GENERATING PLANT (1942). *By "Proton", edited by E Molloy. Published by Chemical Publishing Co, 234 King St, Brooklyn, New York, 150 pages, 5½x8½ in., 59 illustrations. Price $2.50.*

According to the preface of this book, the subject matter deals with cases for which the British Grid scheme is inadequate such as factories where steam is required for process, geographically remote locations that favor diesel installations, standby plants and emergency lighting installations. The book itself is mainly devoted to the discussion of internal-combustion-engine plants and windpower units ranging down from 50 kw with their associated batteries, electrical circuits and maintenance requirements.

PLANT ENGINEER'S MANUAL (1942). *By E Molloy. Published by Chemical Publishing Co, 234 King St, Brooklyn, N. Y. 230 pages, 5x7 in. Price $3.00.*

A pocket book designed to provide plant engineers with convenient reference to mechanical and electrical equipment of industrial plants. Terminology and practice are British.

The four sections are titled (1) sources of power, (2) transmission of power, (3) plant and equipment, and (4) efficiency in works and factories. Steam engines, boilers, valves and fittings, piping, electric motors and diesel engines are treated in 91 pages of text the reader should expect little more than a passing comment on the several items under each subject.

Belt, rope and chain drives are discussed under transmission of power; pumps, compressed-air equipment, electric furnaces, electroplating and welding require only 29 pages; lighting, ventilating, air conditioning and electricity tariffs occupy the remainder of the book.

In brief, this book seems too superficial for the power engineer and somewhat more technical than would be desirable for a layman. S A T

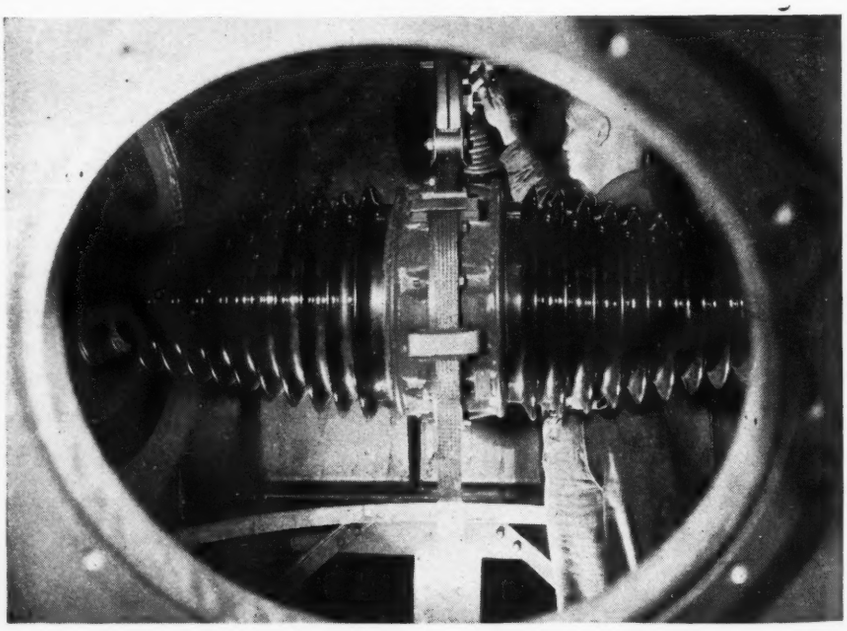
AC Machines

ALTERNATING-CURRENT MACHINES (2nd Edition—1942). *By A F Puchstein, consulting engineer, Celanese Corporation of America, and T C Loyd, chief engineer, Robbins & Myers Co. Published by John Wiley & Sons, 440 4th Ave, New York, N. Y. 655 pages, 6x9 in.; 356 illustrations; 35 tables; cloth binding. Price $5.50.*

The authors of this book have both been college professors of electrical engineering and are now executive electrical engineers for large manufacturing corporations. Therefore in this college text we have the combined thinking of the college professor and industrial engineer, a fortunate combination to have in any engineering text. It is the authors' belief that a thorough text book with bibliography and suggestions for further reading and investigation is of more value to the student than many of the present text books on alternating-current machines, written to meet the needs of a specific course in a particular college. In this book the authors have gone

(*Continued on page* 162)

BIG SWITCH



Setting a new high in size, this 132,000-volt disconnect switch is for one of six large power transformers built by General Electric for a west coast installation. The switch enclosed in its steel casing weighs 11,000 pounds. The casing holds 1660 gallons of oil, which makes the weight of the complete switch almost 12 tons. Picture was taken through one of the inspection manholes.

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Not all information in "Piping Pointers" is solely for trainees. The range of subjects is varied and applies to men who swing the wrenches, and whose job it is to make your piping systems work better and last longer under war operating conditions. Skilled workers say they like to keep "Piping Pointers" handy for *brushing up,* and know they're reliable because they're issued by Crane.

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TO HELP KEEP PIPING ON THE JOB
HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!

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Name .....
Title .....
Company .....
Address .....
City ..... *State* .....

BUMBLEBEE . . .

Some years ago, one of my boys came home proudly with this riddle: "Why is a man more complex than any other animal?" The answer was, "Well, every man has hare on his head, a frog in his throat, a deer in his heart, a wolf in his eye, and a little bull on the end of his tongue." For some reason, that answer has always stuck in my mind, probably because it set me to thinking of how we explain human nature with animal names. Just for example, think of the mental pictures created by such words as pig, goose, chicken, sheep, snake, mule, dog, and ox.

I don't know about men in general, but I do know that power engineers are going to have to be more complex than ever for the period of this emergency. The only kind of fuel oil most oil-burners will get will be coal. If something breaks that baling wire or a welding torch won't fix, we'll probably have to get along without it. There'll be no bright young men to break in, and a shortage of older ones to help meet doubled and tripled power and steam loads.

We'll have to work harder than beavers to keep our plants running. We've got to save fuel and equipment like squirrels and see farther in the dark ahead than owls. We've got to remember maintenance now as we never did before, because what we've got has to do indefinitely.

My old formula for avoiding trouble had three parts: (1) the right nameplates, (2) proper installation, (3) regular inspection and overhaul. No. 3 is the real joker now. An adequate job of maintenance will preserve equipment and prevent trouble—and surprisingly enough, will build and maintain employee morale. That's important now in the days to come. Keep the boys at taking care of the equipment, and the equipment will take care of you—and your plant's power needs.

And for a present-day answer to my son's old riddle, try to be a compound of the ant, the squirrel, the chameleon, the firefly and the bumblebee. The ant holds all records for cooperative plugging, the squirrel remembers tomorrow in the middle of a busy today, the chameleon is the only living thing that can look ahead with one eye and backward with the other, and the firefly still tops all man's records for powerplant efficiency. As for the bumblebees, let me quote a sign in a General Motors plant:

"According to the theory of aerodynamics, and as may be readily demonstrated through wind-tunnel experiments, the bumblebee is unable to fly. This is because the size, weight and shape of his body in relation to his wingspread make flying impossible.

"*But the bumblebee, being ignorant of these scientific truths, goes ahead and flies anyway—and makes a little honey every day.*"

George Edwards

Engineer

For every industrial service there is a JOHNS-MANVILLE INSULATION specially designed to provide highest operating efficiency, long life and maximum fuel savings - - -

Here are brief facts on a few of the most widely used J-M Insulations. For full details, and for information on J-M Insulation Engineering Service, write Johns-Manville, 22 E. 40th St., New York, N.Y.

• • •

FOR STEAM LINES UP TO 600° F.—J-M 85% Magnesia Pipe Insulation. For many years this material has been proving its ability to maintain its high insulating efficiency in service. It is the most widely used power-plant insulation.

FOR STEAM LINES UP TO 700° F.—J-M Asbesto-Sponge Felted Pipe Insulation is recommended where maximum efficiency, salvage value and resistance to vibration and abuse are essential.

FOR HIGH-PRESSURE SUPERHEATED STEAM LINES—J-M Superex Combination Insulation, consisting of an inner layer of Superex high-temperature insulation and an outer layer of J-M 85% Magnesia or Asbesto-Sponge Felted. Combines unusual heat resistance and high insulating efficiency.

FOR BOILER DRUMS, WATER WALLS, FEED-WATER HEATERS, TANKS, BREECHINGS AND UP-TAKES—J-M 85% Magnesia Blocks for temperatures up to 600° F. Strong, durable, lastingly efficient.

FOR COLD-WATER LINES—J-M Anti-Sweat Pipe Insulation—a cold-water pipe insulation designed to prevent condensation and damage from dripping.

FOR REFRIGERATED SERVICE—J-M Rock Cork Sheets and Pipe Insulation—basically mineral, Rock Cork cannot rot and will not harbor vermin or support mold. It is highly moisture-resistant and retains its unusually high insulating efficiency indefinitely. Widely used for refrigerated equipment and piping, air-conditioning ducts and cold-storage rooms.

FOR FURNACE INSULATION—J-M Superex Blocks, for years the most widely used block insulation for temperatures up to 1900° F. Combines high heat resistance with low thermal conductivity.

J-M Insulating Brick (3 types) and J-M Insulating Fire Brick (4 types) for temperatures up to 2600° F. Furnished in all standard 9" shapes of the 2½" and 3" series, as well as in special shapes.

Also J-M Sil-O-Cel C-3 Concrete, cast on the job from Sil-O-Cel C-3 aggregate and cement. Sets up into a strong, durable semi-refractory insulating concrete for temperatures up to 1800° F.

Don't Scrap USED DART UNIONS

...put them Back to Work

Your country needs all your *scrap* . . . but NOT the things that your plant can use again to good advantage, such as old Dart Unions.

Even though a Dart has already given *plenty* of fine service, it can be put back on the job—*with tight-joint performance.* And the reasons *why* Darts can do this are found in the way Darts are MADE: their matched bronze seats, ground to "true-ball" surfaces . . . their air refined malleable iron bodies and nuts that resist rust and rough handling.

Today, you *need* your used Dart Unions—don't throw them away. And when you need *new* ones, get in touch with your supplier promptly.

DART UNIONS

E. M. DART MFG. CO., Providence, R. I.

Harry Carey-Kerr

(*Continued from page* 108)

I saw at once that this was exactly what I wanted. I could cut off the stopper, use it for the leveling bottle, punch a hole for the capillary tube of the burette through the center of the rubber cap, fill the jacket with water, slip the cap in position and the instrument was properly water-jacketed for an indefinite period.

I bought every Kant-Leak stopper Mr Carey-Kerr had in stock. He wrote the factory. They were not making them anymore but had several gross in stock. We bought all of them and immediately ordered a mould so we could have caps made up for us.

I asked Mr Carey-Kerr if he could sell the instruments for me. He said, "Yes, but you don't want to sell them through laboratory supply houses. We don't sell more than a half dozen Orsats a year. We sell from the catalog and across the counter—mostly to laboratories. Yours is not a laboratory instrument—it is an engineer's instrument and will have to be sold *by* engineers *to* engineers". How well he summed up the whole problem for me!

I had not seen Mr Carey-Kerr for almost a quarter of a century. In 1940 I wanted some specific information regarding the capacities of blast-type bunsen burners. I went to the Sargent store and I saw Mr Carey-Kerr sitting at his desk in a glass-enclosed office. As I went to the door of the office, a secretary said, "Come in, Mr Carey-Kerr will see you". I said, "Good afternoon, it has been a long time since I saw you".

He said, "Your voice is familiar, and if I could see your face I would tell you what your name is". "My name is Hays," I said, but before I could go farther he came right back at me: "Now I have you, Hays, the gas-analysis-instrument man! It certainly has been a long time since you saw me. I shall never be able to see you. I have been going blind for a long time. Very soon the little light that I now get will be blotted out forever".

I said, "Mr. Carey-Kerr I can't tell you how sorry I am".

He flashed right back at me and with some spirit. "Why should you, or anybody else, be sorry for me? I am as happy as you are, maybe more so. I haven't a care in the world. I have nobody but my wife to think about. She has nobody to think about but me. We have enough for all of our needs. When I am gone there will be enough for her.

He'll live!...to fight again

IN THE oil-slicked waters of a darkened sea, one of our fighting airmen is forced down. Miles from nowhere—nothing more than a dot on a limitless expanse of ocean—the pilot's life could well be despaired of, were it not for the swift rescue boats whose ever-watchful patrol saves valuable fighting men to fight again.

These crash boats are ready for any emergency, and their ability to get there—in a hurry—is both a tribute to their sleek design and to the highly efficient engines which power them. Behind the whirling propellers which speed these craft through the water are gears—Foote Bros. gears of such extreme precision that until a short time ago, they were considered a laboratory product.

But engines for rescue boats and torpedo boats—engines for fighters, bombers and aerial freighters, called for gears in such quantities that only mass production methods could supply the demand.

And today these "jewels of power transmission" are flowing out in ever-increasing quantities to speed America's fighting forces—in the air and on the waves—to Victory.

The new manufacturing techniques, and new ways of coupling extreme precision with mass production developed in the plant of Foote Bros. mean more and better aircraft and marine engines. These same lessons applied to the world of tomorrow will mean better machines, more compact and more efficient machines produced at costs that promise greater savings to America's manufacturers.

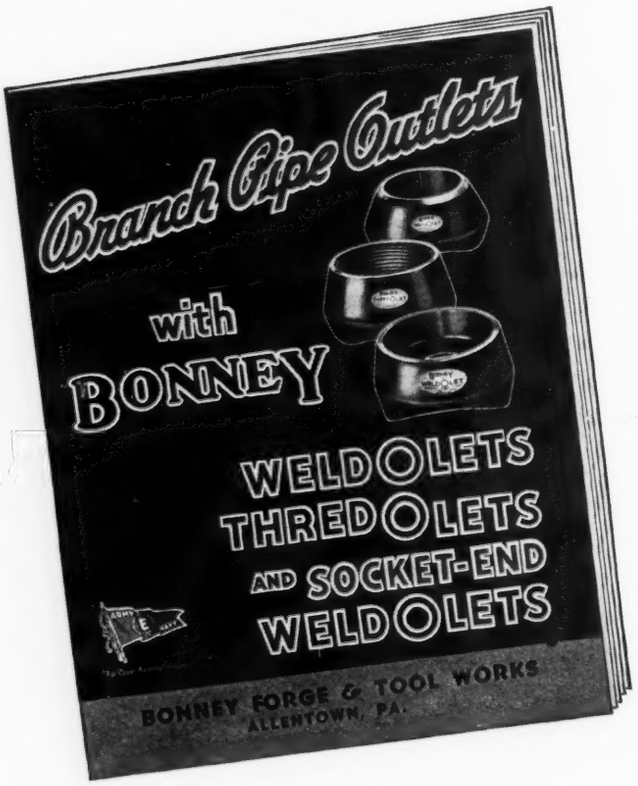
FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 South Western Boulevard
CHICAGO

FOOTE BROS.

Better Power Transmission Through Better Gears

WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

Get Your Copy of this New Catalog Now



JUST off the press, this new 16 page Bulletin WT31 covers more thoroughly and completely than any previously issued information, the advantages of Bonney WeldOlets, ThredOlets and Socket-End WeldOlets in all types of piping systems.

It tells in detail, their purpose; what they are; how you can make right-angle welded branch pipe outlets stronger, better and at less cost; how they will reduce turbulence and friction in piping systems; how to make a right-angle branch pipe outlet in six easy steps; how they fill every piping need whether indoors or outside, above or below ground and whether for new construction or maintenance; their wide variety of applications; their adaptability to manufactured products and shop fabrication as well as complete tables of specifications and dimensions.

Awarded to the Men and Women of Bonney Forge & Tool Works "for great accomplishment in the production of war equipment".

If you use or expect to use pipe fittings for welding, you need this book. Write for it today . . . Bulletin WT31.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

"Blindness is not so bad when one has lived and seen the world. I have seen most of it. I was born in India. My father was a Colonel of the Royal Bengal Lancers. I can close my eyes and see that regiment on parade. I can hear the trumpet calls and the thunder of the charge. I can even smell the dust. Every night I just relax and the Lancers come on parade for me. You can't do that, Hays, for you have never seen the Royal Bengal Lancers."

He went on to tell me that he had been sent to England when a youth and educated there, that he had been pretty much all over the world and seen so much that was worth seeing. "Hays," he said, "there is so much beauty in the world, so much that is worth seeing and remembering. Look for beauty and file the pictures away in your memory. Then you can pull the pictures out whenever you wish to look at them. A mental picture is so much more satisfying than any other kind, unless, perhaps a colored movie on the screen, which I have never seen."

He went on in that line until I almost began to envy him and feel sorry for myself. Then he pushed a button and called a clerk: "Show Mr Hayes these burners"—He handed the clerk a slip on which he had penciled the catalog numbers. Then he told me to come in again some time, turned to his desk and called his secretary.

The last time I called his office I was told that he seldom came down town any more. I know what he is doing at this moment in his home in Winnetka—if he is not listening to the radio or talking with somebody. He is walking down Piccadilly in London, or through St. James' Park, or looking at the high peaks of the Himalayas, or the long rollers of the Pacific breaking upon the California shore—or upon any of a thousand other "beautiful" sights that are filed away in his memory.

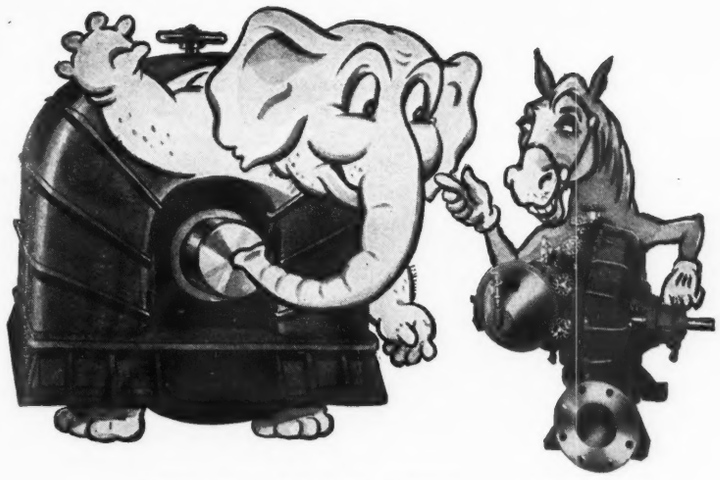
Here's to you Mr Harry Carey-Kerr, —my helpful friend of other years! I am not sorry for you. I congratulate you. You have inspired me.

Readers' Problems

(*Continued from page* 126)

Inlet Steam Throttled

GEB'S INDICATOR CARD shows faulty valve setting and faulty valve mechanical condition. The shape of both admis-



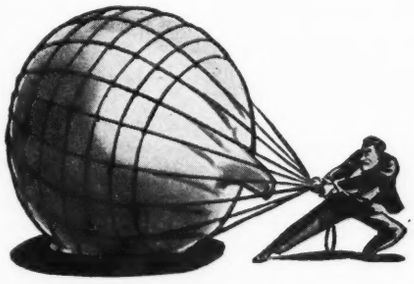
FOR SMALL HP JOBS . . . BUY HORSEPOWER . . . NOT ELEPHANT POWER

When you see a "Blue Ribbon" steam turbine on a small-sized pump, blower or other small unit . . . you'll know that the turbine *fits* the job — you aren't paying extra for "Elephant Power."

Coppus "Blue Ribbon" Steam Turbines are built in six sizes (and prices) with ratings from 150 HP (smallest unit in most makes) down to fractional. When a small turbine is all you need, a Coppus will save you investment cost and floor space. Steam, air or gas-operated. Precision-built (like all "Blue Ribbon" products); dynamometer tested. Partial load economy secured by individual nozzle control.

Write for Bulletin 135-9

COPPUS



FANMIX SAVES 5000 CU. FT. OF NATURAL GAS PER HOUR

An Arkansas plant which had installed Coppus-Dennis Fanmix Gas Burner on a kiln, reports getting increased production at a saving of 13.5 % in gas consumption.

Investigate Fanmix for your boilers, kilns, stills. New principle provides perfect gas-air ratio and complete instantaneous combustion.

Another "Blue Ribbon" product.

Write for Bulletin 410-3

COPPUS

COPPUS BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY...ENGINEERED FOR YOU

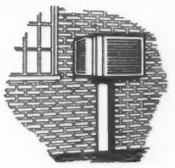
COPPUS ENGINEERING CORPORATION

332 Park Avenue, Worcester, Mass.

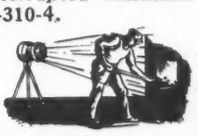
Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S PRODUCT REFERENCE.

You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

(Check the ones you want)

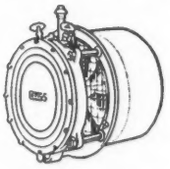


☐ Coppus Air Filters. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.



☐ Coppus Heat Killers. Keep production up by keeping men cool. No stale air recirculation. Air is directed. Bulletin 160-5.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.



☐ Coppus Type C Turbo Blower. For undergrate draft. Bulletin 145-6.

☐ Coppus Boiler Manhole Blowers and Exhausters. For cooling boilers, drums, etc. Bulletin 161-3.

☐ Coppus Steam Turbine (described in this ad).

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad)

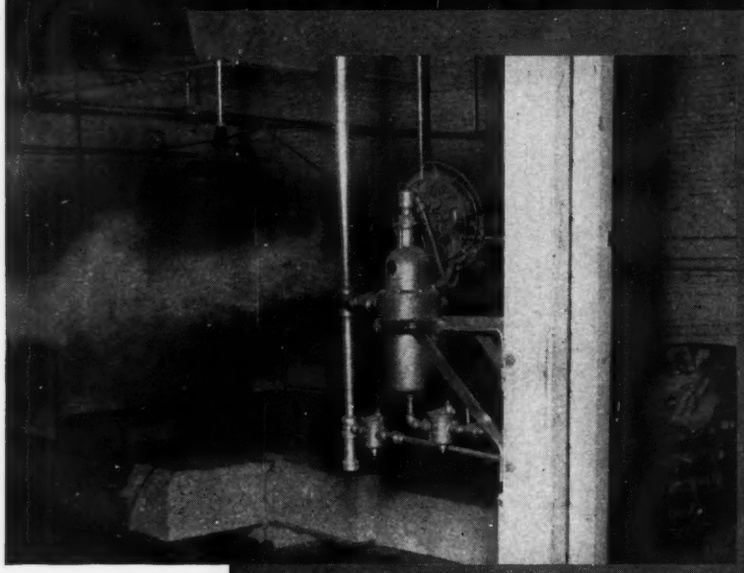
NAME .....

COMPANY .....

ADDRESS .....

Armstrong Humidification

Speeds Production! Reduces Waste!



HERE'S WHY—

1. PREVENTS loss of weight, strength or quality of hydroscopic materials.
2. IMPROVES workability of materials.
3. CONTROLS troublesome or dangerous dust and static conditions.
4. PROVIDES healthier working conditions.
5. CONTROLS drying processes.

THESE ARE A FEW of the industries using Armstrong Steam Type Humidifiers:

- Chemical
- Paper
- Printing
- Woodworking
- Ceramics
- Leather
- Tobacco
- Aircraft
- Textile
- Rubber
- Paint
- Cosmetics
- Food
- Metal Working

WRITE TODAY for free copy of new bulletin "Armstrong Humidifiers for Industry". It tells how Armstrong Humidifiers are being used advantageously in practically every industry for a wide variety of applications.

IF dry air stymies production and causes excessive spoilage in your plant, the compact unit above may hold the solution to your problem. Hundreds of plants all over the country are proving the value of Armstrong Steam Type Humidifiers for combating all the evils of low relative humidity.

Armstrong Humidifiers are low in cost—the model illustrated lists for only $100 complete with sensitive Friez humidistat and all accessories and is capable of handling up to 40,000 and more cu. ft. of space. Installed and used as simply as unit heaters, connected into existing steam lines and electrical circuit. Let us send you detailed information. There is no obligation.

ARMSTRONG MACHINE WORKS

812 Maple Street • Three Rivers, Michigan

BUILT BY THE MAKERS OF ARMSTRONG STEAM TRAPS

sion and expansion lines indicates leaking valves, also some throttling of inlet steam as average admission pressure is less than 60 psi. If the points stated by GEB have been carefully checked, reconditioning the valves and valve gear and correctly setting the valves should cure the trouble. Failure of the admission lines to reach full steam pressure is the greatest single defect and the cause of this throttling should be carefully investigated by examining the valves and all steam passages. Other defects include leakage during and after cutoff, unequal work at the two ends of the cylinder, and too high compression at the crank end.

St John, N. B. C G CLARK

Earlier Admission

THE INDICATOR DIAGRAM presented by GEB indicates uneconomical operation of his engine. The compression is about 20% higher on the crank than on the head end. This condition alone would tend to cause a knock with the slightest excess clearance in crosshead or crank bearings. Admission and cutoff are late on both head and crank ends.

I suggest that GEB make adjustments for earlier admission on both head and crank ends by setting the eccentric ahead. The valves should then be adjusted to give the correct compression on both ends.

New York, N. Y. ANTHONY GREER

Eccentric Shifted in Wrong Direction

GEB PRESENTS an interesting indicator card; it shows at once that there is something wrong with valve motion.

Beginning with the forward stroke, compression is early, but not too early if the admission was properly timed. The compressed steam re-expands to 60% of the compression pressure before admission begins. Compression of the steam in the cylinder to several pounds higher than that in the steam chest will cause some valves to lift and tap.

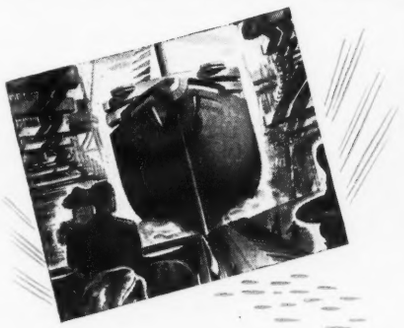
On the return stroke, we find a similar compression re-expansion line. This definitely places the cause of the trouble outside the valves themselves, as a sticking valve would hardly duplicate the motions of another at the opposite end of the cylinder. Also, with some valve gears it is possible to get the rocker turned upside down or reversed. The appearance of the card leaves the impression that the eccentric has been shifted to give negative lead.

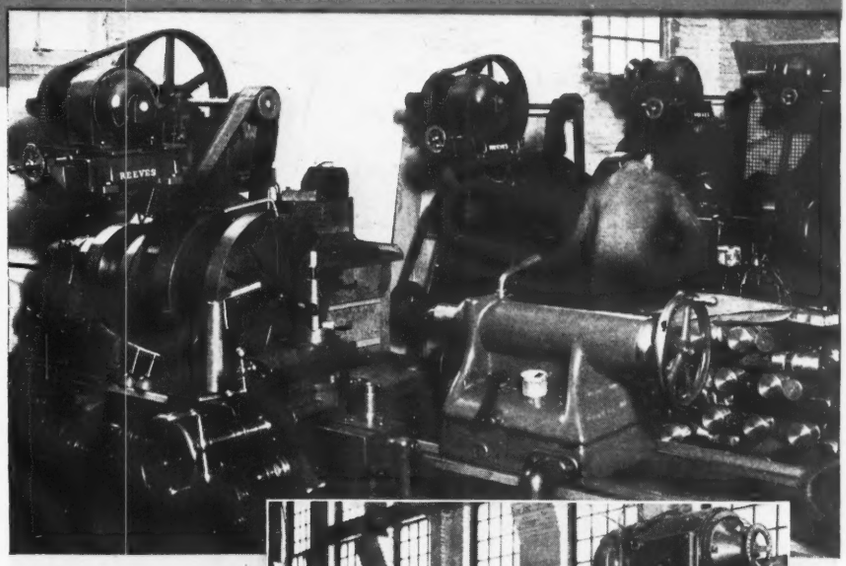
Menard, Ill. GEORGE HOLMAN

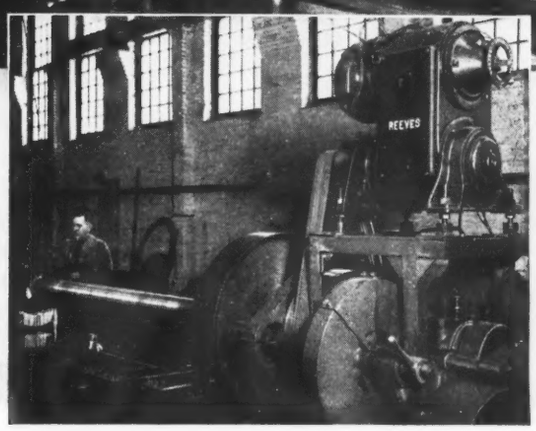
NEW LIBERTY SHIP ENGINES

from scratch in 90 days

. . . with Old Machines Equipped with REEVES Variable Speed Drives







Views of plant featured in this advertisement, showing lathes equipped with REEVES Variable Speed Drives. Approximately 20 REEVES units are in use in this one plant, including the Motodrive, Transmission, and Vari-Speed Motor Pulley.

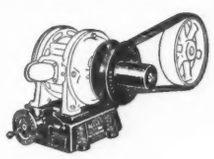
A group of industrialists in a West Coast city wanted to help meet the government's call for more ships. They had a plant—they had the experience—they had the backing. They were offered an order for triple-expansion main propulsion engines for Liberty Ships. But, they didn't have enough machine tools—and new tools were not to be had. There was no time and little material for building new tools. So they took old, obsolete machines—the only kind they could get—equipped many of them with REEVES Variable Speed Drives for complete speed adjustability, and went to work.

Within 90 days the first engine was delivered. Today a steady stream of engines is being turned out. This record is certainly a tribute to American ingenuity and resourcefulness, and REEVES is proud to have had a part in it. . . . Booklet PG-423 gives other examples of how REEVES drives give old machines greater precision and help new operators save time and material. Write for it.

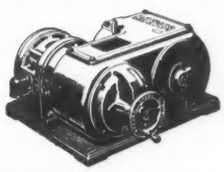
REEVES PULLEY COMPANY
COLUMBUS, INDIANA

THE 3 BASIC UNITS IN THE REEVES LINE

VARIABLE SPEED TRANSMISSION for infinite speed adjustability over wide range—2:1 through 16:1. Fractional to 87 h.p.



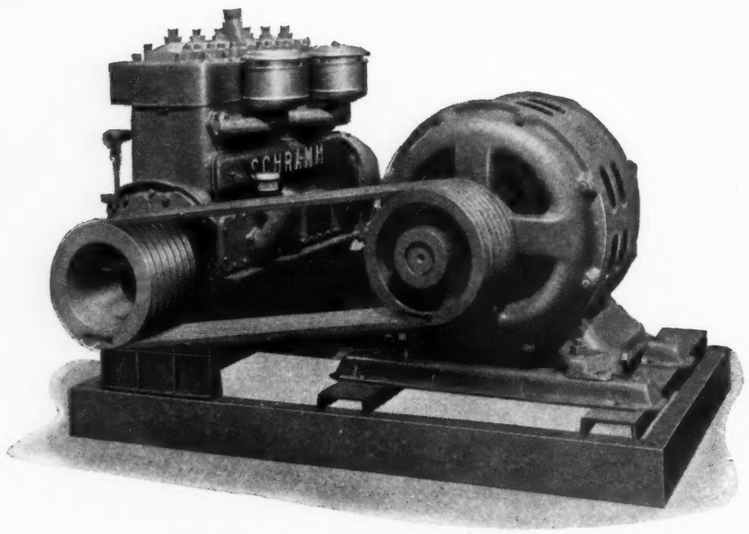
VARI-SPEED MOTOR PULLEY for application to shaft of any standard constant speed motor; 3:1 range. To 15 h.p. Forms actual drive to machine.



MOTODRIVE—Combines motor, variable speed drive and gear reducer (if needed) in one compact unit. To 10 h.p.; speed range 2:1 through 6:1.

REEVES *Accurate Variable* Speed Control

A-1-A
PRIORITY ON PERFORMANCE



"V" Belt Drive On Base With Motor

• Throughout the many years of SCHRAMM operation they have been tops in performance; so now when economical, dependable and speedy performance is necessary in the present Victory drive, SCHRAMM is prepared to answer the call.

SCHRAMM Compressors are designed for heavy-duty, continuous service and will perform such service with least up-keep and operating costs. They are available for flat belt or complete "V" belt drive, "built-in" motor drive with compressor and motor assembled rigidly and in perfect alignment. Units are light, compact and easy to handle, reducing headroom and floor space requirements.

BUILT IN SIZES
from 50 to 600
Cu. Ft. Displacement

WRITE FOR CATALOG 42-S

SCHRAMM INC., WEST CHESTER, PA.

SCHRAMM *Air Compressors*

Argument Corner

(*Continued from page* 128)

many pressure vessels ruined by corrosion around the head seam—in New York State there is no Unfired Pressure Vessel Code—and leakage begins at the lower head. Seal welding is resorted to, often being done by acetylene torch, allowing a dangerous condition to exist.

In these days, when it is impossible to get new equipment or repair parts on short notice, if at all, anything that can be done to preserve the economic life of necessary plant is worth while. If air receivers are blown down, and then vented through some opening in the upper part, a drain at the lowest part opened, and the vessel left overnight, much of the sludge adhering to the sides of the shell will trickle down and drain off. If the air is used in food products, or for blowing off finished work, the dry clean air is important, and if rubber hose is used, its life will be increased if the air is dry and cool and especially if it is free of oil vapors.

Buffalo, N. Y. ALON CARTER

Connecting Rod Angularity

I WOULD LIKE TO SUBMIT the following comment, or version about "Angularity of Connecting Rod," as outlined by Mr Hudson in the August Issue of POWER.

I don't quite agree with Mr Hudson, because if a circle with 1-in. radius is scribed, 3.1416 × 2 in. equals 6.2832 in. is obtained, the actual circumference of a circle with 1-in. radius. Now let us assume this to be crank travel. A 1-in. radius will take care of a 2-in. engine stroke. This piston travels 4 in., to the cranks 6.2832 in. Actually the crank travels 2.2832 in. more than the piston. In one stroke the piston will travel half of this, or 1.1416 in. more than the piston. The last distance is the amount crank travels either side of engine horizontal center line, while piston is stopped at each end of the stroke. We are all aware that the piston has to stop at each end of stroke, so that it will start in opposite direction. This is where the flywheel comes into the picture to carry crank past dead center to a point where force is again given the crank by mean effective pressure acting on piston.

It Takes a Beach-Head to Start an Invasion

This welded steel amphibian tractor is the Marines' answer to tough "competition" that beat us to the offensive, then dug in.

ALTER EGO: Those few Marines may not win the war by themselves, but they will establish a beach-head and that's a mighty vital prelude to dislodging Axis "competition".

Yes, war is like that. Business now is somewhat like that. Business after the war will be just like that!

ALTER EGO: Right. To win the Battle for Business after this war we're going to have to get on the offensive with welded steel products.

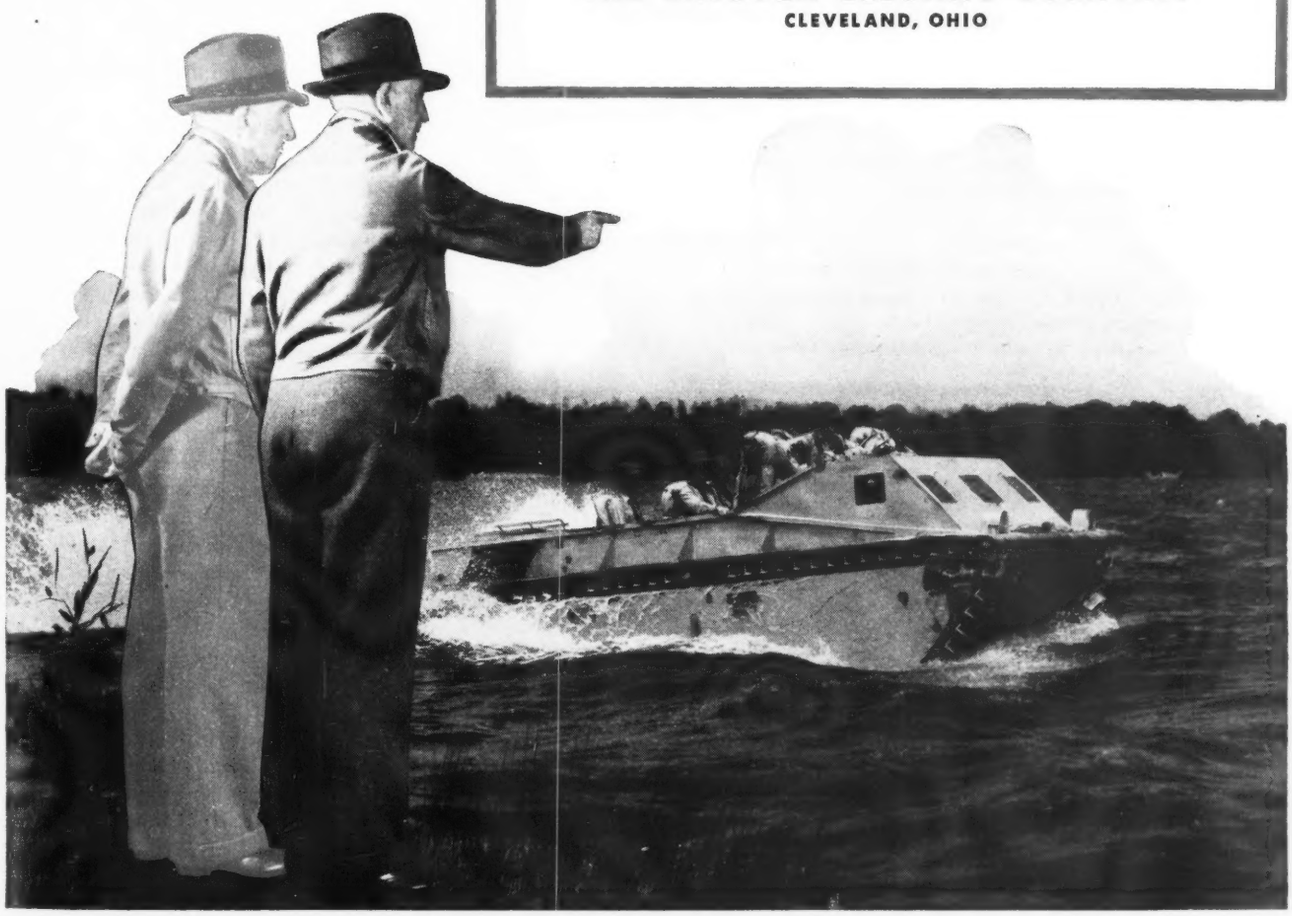
Right. But first we must establish our beach-heads of welding knowledge. Let's start this prelude to invasion of the post-war market NOW.

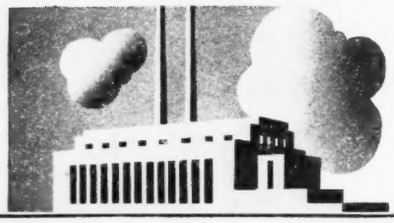
Ask *your* inner self if a "beach-head" of welding knowledge shouldn't precede post-war market invasion.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

MARINES and WELDING
—the situation will be well in hand





How to Guard Your Boilers Against Oxygen Corrosion

By K. R. FOX, Organic Chemicals Division
MONSANTO CHEMICAL COMPANY

EVEN in power plants protected by good, efficient mechanical deaeration or where distilled water is fed to the boilers there is always danger that overloads or leakage of air into the boiler system may cause oxygen corrosion. Especially in these days when equipment is often almost impossible to replace and a shutdown for repairs might cripple vital war production, few engineers can afford to risk that danger.

Fortunately, however, over ten years' experience in hundreds of power plants have proved that continuous treatment of your boiler feed water with Santosite (Sodium Sulfite) will give you excellent protection. Once added to the extent of about thirty parts per million, a simple test will reveal the amount of Santosite present and provide a reliable check on any increases in oxygen due to increased loads or air leakage into the system before serious damage can be done.

APPLICATION AND CONTROL

An anhydrous, crystalline product, Santosite is easy to handle and store. To apply, a given amount of Santosite is dissolved in water and the solution fed either periodically or continuously into the feed water after the feed water has passed through the mechanical deaeration equipment. Periodic "dosing" is satisfactory if economizers are not used. When economizers are used it is but to carry a constant feed of the Santosite solution to prevent corrosion within the economizer due to liberation of oxygen when heat is applied.

Protection of your boiler is assured by the maintenance of about thirty parts Santosite per million parts water, and one simple test (titration against standard sodium thiosulfate solution) made periodically on samples drawn directly from the boiler gives you an accurate check on the ratio being maintained. The fact that Santosite is present presupposes the absence of oxygen in injurious amounts. Any increases in oxygen due to increased loads or air leakage will be revealed by a reduction in Santosite and the trouble can be promptly corrected.

COST OF SANTOSITE PROTECTION

Depending on the oxygen content of water treated, the cost of insuring your boiler system against oxygen corrosion with Santosite will vary from $0.05 to $0.65 per million pounds of feed water. Even at the higher figure its use has proved economical in many plants.

For full details, write: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal.

MONSANTO CHEMICALS

"E" for Excellence—The Army-Navy "E" burgee, "representing recognition by both the Army and the Navy of especially meritorious production of war materials," has been awarded to Monsanto and replaces the Navy "E" first awarded Monsanto December 31, 1941.

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Now I wonder if Mr Hudson has ever noticed a beam engine in operation on a side-wheeler steam boat. This is where you will see piston stop, while the crank is in motion at all times. The beam causes the pause at end of the stroke to be greatly increased because of the compounding of distance in beam swing.

There is further statement of the effect of angularity being so effective that it effects crank-end cutoff in this type of engine. I have operated a number of engines of the Corliss type and, also worked as erecting engineer. At no time did we ever have trouble getting equal cutoffs for either end of the stroke, unless worn condition existed or we found mechanical defects in the valve gear.

Cambridge, Mass.

FRANK HAWORTH

About Arguments

REFERRING TO YOUR "All Right—Let's Argue", in the recent issue of POWER, the idea is timely and if handled judiciously, should lead to some good, practical information .Too many opinionated, one-sided or even incorrect statements by contributors, in POWER too, go unchallenged for lack of a forum.

May I also be permitted to call your attention to a tendency of the authors of some articles to offer long-winded descriptions of equipment and arrangements of same that can be found in any good handbook as published by your company, instead of giving what the practical man calls "meat". Just at random, I am referring to "Make Deaerating Heaters Suit Plant Cycle" in the October issue of POWER. To be more specific, the paragraph on page 88, beginning with "Industrial power plants" is decidedly weak. For the power-plant man, whose work may entail the development of a feedwater stage heating arrangement or who may have to provide for a deaerating heater in an existing plant, a clear and usable description of what has been done in successful plants and, in general, the experience had with various hookups would be of vital interest.

Furthermore, the author's description of the determination of the capacity of a direct-contact heater, especially in connection with the diagram offered in Fig. 2, is open to criticism. For such arrangement, showing all the steam returning to the boiler (or boilers) would not the maximum possible steam generation of the boiler plus the customary margin of from 15 to 25%, for blow-

We've Spilled the WORKS!

All the works—two discs and two wedges—four parts—the entire working part assembly of a Darling Double Disc Gate Valve. The seats are parallel. The discs are *fully revolving*, seating in a different position *each time* the valve is operated. This means tighter seating, less wear, longer operation, and lower maintenance costs with Darling Gate Valves. All four working parts are uniform and positive in action. They are simply designed, with no pockets to collect sediment or prevent free and easy movement. Any part can be replaced quickly and inexpensively without removing the valve from the line. They cannot be incorrectly assembled or become disengaged while in service. It's an assembly that will more than pay its way in your plant.

At your service are the engineers of the Darling Valve & Manufacturing Company. They can solve your valve problems without cost or obligation to you. Wire or write, setting appointment at your convenience.

Darling offers you a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, you can get Darling Gate Valves in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

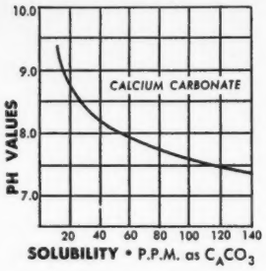
TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

HOW TO MINIMIZE SCALE AND INCREASE PLANT EFFICIENCY WITH *Beckman* pH CONTROL

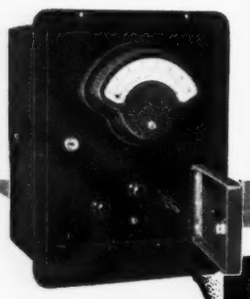
Less scale in your boilers, feed lines, condensers, valves, etc., means reduced maintenance, less "down time" and higher operating efficiency. Here's what Beckman pH Control can do . . .



Scale deposits are one of the most costly and persistent of boiler plant problems. Hard scale on the heating surfaces not only reduces heat transfer to the boiler water, but—more destructive—it insulates the metal from the cooling effect of the water, causing early tube failure and expensive repair work. And scale, once formed must be removed mechanically—which means further high maintenance and costly boiler "outage."

Today, power plant operators are finding that they can greatly reduce scale problems by Beckman-controlling the pH of their feedwater processes to prevent scale-forming chemicals from reaching the tubes. Notice in the accompanying chart how the solubility of calcium carbonate rapidly decreases as pH is increased, reaching its minimum at pH 9.4 and above. Similarly, other scale-producing compounds reach their minimum solubilities at high pH values.

This means that by accurately controlling pH during the feedwater treatment, most of the scale-forming compounds can be precipitated out of the water *before* they reach the boiler and condenser tubes. Then by *lowering* the pH of the feedwater *after* the precipitation process, the little carbonate that remains can be held in solution more easily, reducing scale formation to an absolute minimum. This pH regulation can be maintained *automatically* with Beckman pH Equipment—the only pH equipment that provides the high temperature electrodes necessary for this maintenance-saving application!



And reduction of scale is just one of the *four* important savings Beckman pH Control can make in your power plant operations. Let our engineers recommend equipment to increase the operating efficiency and decrease the maintenance costs of *your particular* power plant operations!

BECKMAN pH CONTROL
1. Minimizes Scale
2. Reduces Corrosion
3. Improves Coagulation
4. Conserves Chemicals

NATIONAL TECHNICAL LABORATORIES
SOUTH PASADENA • CALIFORNIA

Beckman THE LEADING NAME IN pH

down, soot-blower supply, raising low-drum water level and losses by safety valve blowing and drips, be the simplest way to determine the required heater capacity?

Kindly accept this not as a criticism but as an effort to be of help to young engineers who are rapidly being pushed into positions for which they lack the experience of older men and who have to rely a good deal on information obtained from magazines.

BRUNO F KOCH.
Power Plant Engineer

New Power Construction

Construction to Come

Ariz., Marana—U. S. Eng, 751 S Figueroa St, Los Angeles, Calif., plans constructing imprvs. Over $2,000,000.

California—Bids Nov 2, by Bureau Reclamation, Denver, Colo., furnishing six structural-steel pier-nose columns, grillages and accessory metal work, for turbine-draft-tube piers at Keswich Power Plant, Kennett Div, Central Valley Project, Spec 1672-D. S O Harper, ch engr.

California—Maritime Comm, 1818 H St, N W, Wash., D. C., plans constructing bldgs $1,000,000.

Conn., Bridgeport—Dept Pub Wks, plans constructing sewage disposal plant, East End, Seaview Ave and Walker St, and addnd expansion Boswick Ave plant, West End. $3,000,000, FWA.

Iowa—U. S. Eng, Clock Tower Bldg, Rock Island, Ill., plans constructing imprvs. Over $2,000,000.

Iowa, Cedar Rapids—Iowa Electric Light & Power Co, F C Chambers, genl mgr, Security Bldg, plans constructing steam-generating unit $1,200,000; turbine addn $700,000.

Kansas—U. S. Eng, Albuquerque, N. M., plans constructing imprvs, bldgs, facilities, $4,000,000.

Kansas—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing imprvs. Over $1,000,000.

Kansas—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing imprvs, bldgs. $2,000,000.

Nebraska—U. S. Eng, 1709 Jackson St, Omaha, plans constructing imprvs, Dodge Co, over $2,000,000.

Nebraska—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructng improvements. Over $2,000,000.

Nebraska—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing imprvs. Over $2,000,000.

Nebraska—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing imprvs. Over $2,000,000.

Nebraska—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing imprvs. Over $2,000,000.

New Mexico—Bids about Nov 7, by U. S. Eng, Albuquerque, air conditioning

CAUSES OF TURBINE OIL EMULSIONS AND CORROSION

AND HOW NONPAREIL TURBINE OIL HELPS PREVENT THEM

Turbine oils that do a good job of preventing corrosion usually sludge pretty quickly. And, vice versa, a turbine oil that's relatively sludge-free is much more likely to permit corrosion.

WHAT MAKES OIL AND WATER MIX?

An emulsion, which is a mixture of oil and water, is usually caused by one of two things, or both. No. 1 is dirt in the oil such as dust and other foreign materials which get into the oil during handling and operation. No. 2 is something in the oil itself—unstable hydrocarbons, asphaltenes and organic acids, say the chemists, are the most common. These help make sludge. What is desirable in a turbine oil is good demulsibility—the ability to separate readily from water.

WHAT CAUSES CORROSION?

Turbine oils don't cause corrosion. Corrosion is caused by *water*, if the turbine oil *permits* it. A turbine oil that doesn't wet the metal and stick to it, may let water push it off the metal surface. That's when rust starts. So the thing an oil needs is ability to wet the metal—wet it with oil, that is, and stick to it.

WHICH DO YOU WANT—DEMULSIBILITY, OR CORROSION PROTECTION?

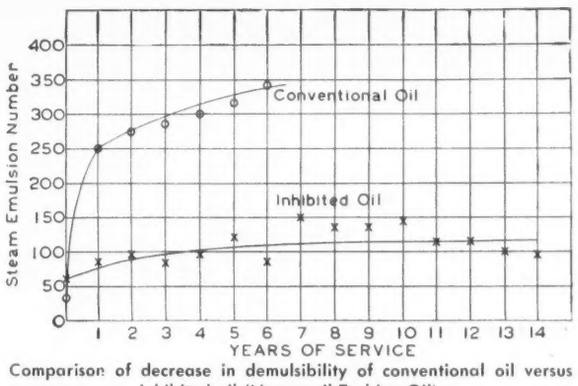
There's nothing hard about making an oil that will stick to metal. Ordinary black oil does a swell job. Paraffine oil with a little lard oil added does an outstanding job of wetting metal and sticking to it. But—and here's the trouble—these oils that stick to metal so well do not separate readily from water. They mix—and sludge starts.

There's been a lot of talk lately about adding a little of the old oil to new oil, to prevent corrosion. The old oil has higher acidity than new oil and is more likely to stick to metal. But with that method you simply gain rust protection at the expense of sludging.

Most oils have been a compromise between good demulsibility and good wetting ability. Refiners have had to make an oil that was highly demulsible, and hope for the best so far as corrosion was concerned; or to make an oil that gave good rust protection, and ask that it be changed or treated when its acidity rose and sludging was threatened.

HERE IS A WAY OUT OF THE DILEMMA

Some years ago, Standard Oil research men found a way out of the dilemma. They made a highly refined oil that separated readily from water. Just to make sure that it wouldn't sludge, they added a patented inhibitor—a chemical which keeps the acidity down.



Comparison of decrease in demulsibility of conventional oil versus inhibited oil (Nonpareil Turbine Oil).

So far, so good. But what about rust? Rust, you remember, occurs because oil lets water push it off the metal. We need an oil that will really wet the metal, and stick to it. This fine, high-grade non-sludging oil alone wouldn't do that as well as some other oils.

So they developed a corrosion inhibitor, which makes this non-sludging white oil wet metal, and stick to it. This inhibitor has been added to Nonpareil Turbine Oil since 1927.

WE GUARANTEE NONPAREIL TURBINE OIL IN WRITING

To men who know turbine oil problems, it seems unbelievable to get a turbine oil that is superior *both* in freedom from sludging and in prevention of corrosion. To assure them that Nonpareil is really something out of the ordinary, we issue a signed guarantee for each installation.

The best way to forecast sludging is by a rise in acidity. So we say, watch the acidity of your oil. (In fact, we watch it for you, by regular sample analysis.) If, says our written guarantee, the neutralization number rises beyond 0.15 mg/KOH gm., when the temperature of the oil from the bearings has been kept below 170° F., we will cheerfully replace the entire batch of oil.

Proof enough, isn't it? But here's more. Right now, 640 turbines are operated on Nonpareil Turbine Oil. Many of them are the second and third turbines in the plant on Nonpareil. Many have been operating 10, 12, 15 years on the *same batch* of Nonpareil, and the rest of them will be operating that long and longer, in a few more years. We guarantee Nonpareil Turbine Oil for the life of the turbine. And that is usually pretty long, especially when it runs on Nonpareil.

Drop us a card, or, if you're in the Middle West, phone the nearest Standard Oil Company (Indiana) office for a turbine oil specialist. If you are technically minded, ask for our Engineering Bulletin No. TN-571 on Turbine Lubrication with Nonpareil Turbine Oil.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA)

•LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATION E

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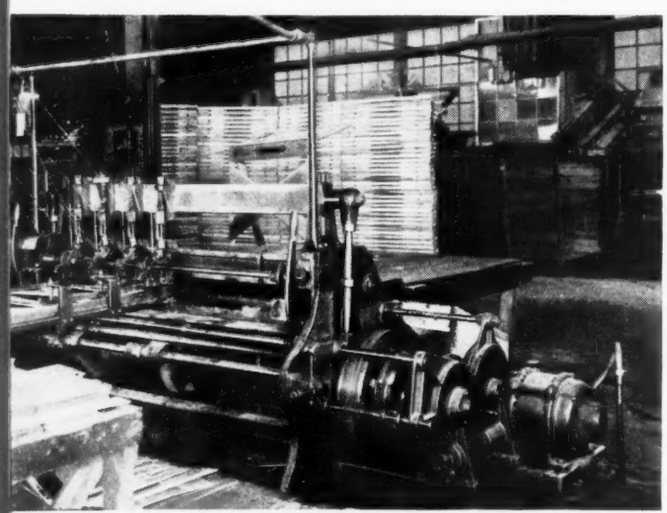
HOW TO SAVE
MAINTENANCE MATERIALS AND MANPOWER

Your plant is one in a million if the scarcity of manpower and replacement parts aren't problems. It's one in many hundreds of plants if better lubricants and better lubricating methods can't help you save on one or both of these maintenance items. And here's how to find out if you can save:

Pick out equipment on which you have made replacements recently—where bearings failed or where oil systems or gear cases became fouled. Let a Standard Lubrication Engineer see if he can find the cause of the trouble. Here's a typical example:

The operator of the machine (below) found that the grease used in the clutch mechanism left a resinous



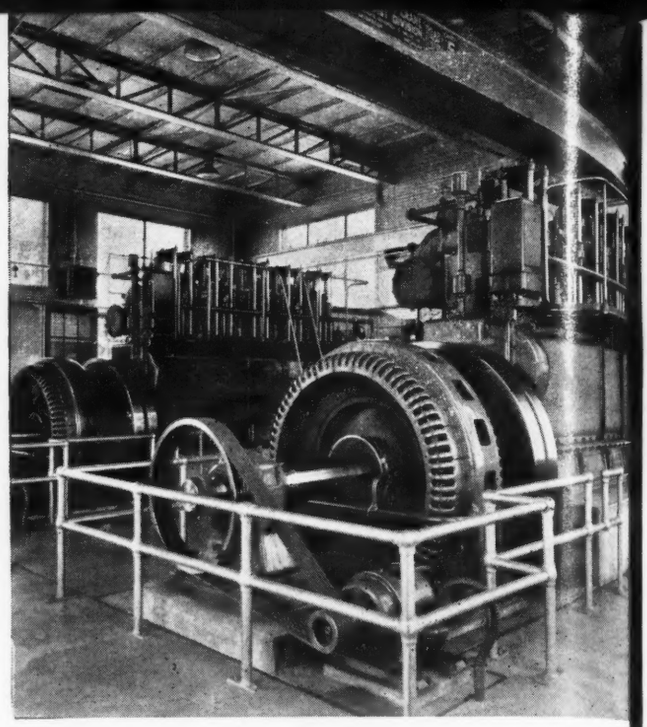
Monthly cleaning of clutch cases on this box stapling machine was eliminated by changing to Superla Grease.

deposit. In spite of the fact that the case was cleaned monthly—a waste of maintenance and machine time—clutch rings showed signs of wear. But there might be an even greater delay if clutch rings had to be replaced.

The problem was given to a Lubrication Engineer who analyzed operating conditions and recommended a grease that would meet the conditions without separating.

Superla Grease, which he recommended, shows no signs of forming deposits in the clutch case after six months of operation. Clutch ring wear is greatly reduced, and the operator has stopped worrying about clutch failures.

This is the advantage of getting a Standard Lubrication Engineer's help. He can match the product to the job. It eliminates time-taking experiments.



KEEP DIESELS ON THE LINE WITH LESS CLEANING...LESS REPAIRING

NONPAREIL DIESEL OIL

Repairs were less than $10 last year on each of the Diesels in a Missouri municipal light plant, pictured above. One engine gave over 6,400 and the other 7,700 H.P. hours per gallon of lubricating oil. Moreover, Nonpareil has been used for three years without a sign of sludging or ring sticking.

Records like this for low maintenance and low oil consumption mean a lot in times like these when conservation of labor and parts becomes increasingly important. They indicate what you can expect.

Test Nonpareil Diesel Oil in your engines. Prove just how clean and trouble-free your Diesel operation can be. A Standard Lubrication Engineer will help you make the test.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or 910 South Michigan Ave., Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

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STANDARD OIL COMPANY (INDIAN

THESE R/M PACKINGS stand up and take it!

Tough as an elephant's hide, R/M packings stand up under today's higher pressures in steam lines, oil lines, fuel lines, and air lines. They never forget that their job is *transmission* of power and not *emission* through leaks or blowouts.

In R/M laboratories, engineers bend over formulas and testing-apparatus, then apply their new-found knowledge in the field, to improve the performance of R/M packings wherever and whenever possible. R/M packings are helping to win the battle of production!

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy from your R/M distributor, or write us direct.

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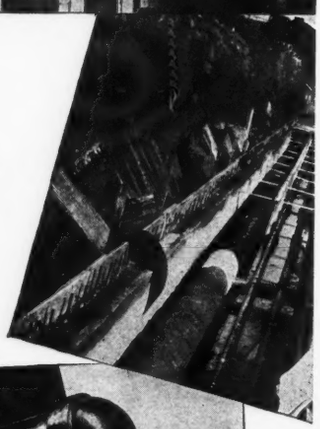
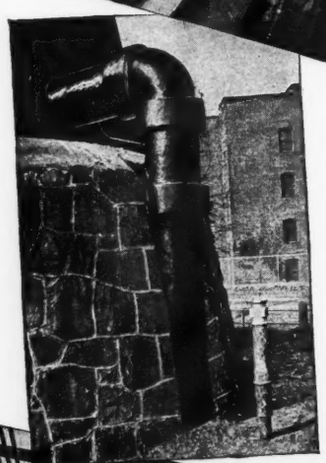
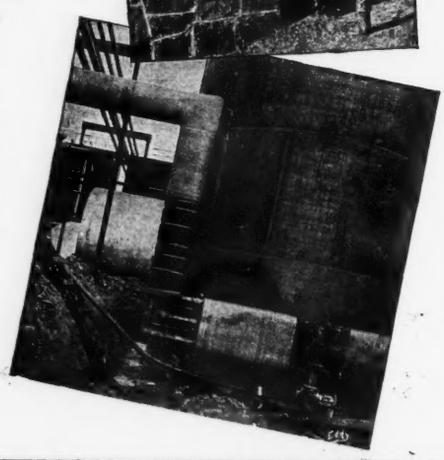
BALDWIN-HILL No. 100 Pipe Covering



Reduces Waste . . . Steps up Efficiency . . . Cuts Cost of Piping Steam

With war industry working at top speed, more and more strain has been put on the facilities for the generation and transportation of steam. To cover this latter requirement, B-H No. 100 Pipe Covering has proved highly efficient, long lasting and most economical. It is effective up to 1000° F. and being made of chemically stable B-H black Rockwool it has a low alkalinity factor which insures long life and peak efficiency under severe heat and moisture conditions. *Send for Bulletin giving complete engineering data and specifications for application.*





Photos from Top to Bottom:

B-H No. 100 Pipe Covering on 6" Steam Line finished with 28 gauge metal jacket.

B-H No. 100 Pipe Covering 3" thick, on 12" Underground Steam Line, finished with 45 lb. roofing felt.

B-H No. 100 Pipe Covering on 12" Pipe finished with B-H No. 1 Insulating Cement and B-H Weatherseal.

B-H No. 100 Pipe Covering on Steam Traced Lines.

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B-H Black Rockwool BLANKET . . . B-H MONO-BLOCK
B-H No. 100 PIPE COVERING . . . B-H MINERAL FELT
B-H No. 1 INSULATING CEMENT . . B-H WEATHERSEAL
and other heat insulations effective up to 2000° F.

and dust-proofing bldgs. Plans deposit $75.

New York—U. S. Eng, 960 Ellicott Square Bldg, Buffalo, letter of intent with E I duPont de Nemours & Co, Inc, du Pont Bldg, Wilmington, for constructing expansion manufacturing plant, Niagara Co. Over $1,000,000.

Ohio, Cleveland—Cleveland Electric Illuminating Co, V H Hartman, purch agt, 75 Pub Sq, plans constructing electric substation. $195,000.

Pa., Butler—U. S. Eng, 925 New Federal Bldg, Pittsburgh, plans conversion Western Pennsylvania Tuberculosis Hospital. Over $2,000,000. Hunting, Davis & Dunnells, 1150 Century Bldg, Pittsburgh, archts.

Texas—American Republic Petroleum Co, Petroleum Bldg, Houston, receiving bids altering refining plant, $2,000,000 or more; constructing new unit, remodeling existing plant, $1,000,000. Federally financed.

Texas—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., plans constructing addnl work for plant. $2,930,000. Industrial company will operate.

Texas—Bids about Nov 7, by U. S. Eng, Albuquerque, N. M., air conditioning and dust-proofing bldgs. Over $25,000.

Texas—U. S. Eng, Fort Sam Houston, plans cold-storage sys, incl railroad siding, Spec 42-519, Bexar Co. Plans deposit $25.

Texas—Bids about Nov 6, by U. S. Eng, Fort Sam Houston, constructing storage warehouse, underground utilities, etc, Spec 42-429, Bexar Co. $60,000.

Wash., Benton—Pacific Can & Foundry Co, Benton, plans constructing foundry. Est complete $3,000,000. O D Conver, 1740 E. 12 St, Cleveland, Ohio, engr.

Wash., Mead—Bids Nov 2, by L C Stewart, purch officer Bonneville Power Admin, P O Box 3537, Portland Ore., furnishing 15-kv oil circuit breakers for substation, Inv 2925.

Wash., Mead—Bids Nov 3, by L C Stewart, purch officer Bonneville Power Admin, P O Box 3537, Portland, Ore., furnishing carbon-dioxide fire extinguishing sys for substation, Inv 2927.

Wash., Seattle—City, County-City Bldg, new bids soon increasing height of Ross Dam, $10,000,000. Additional funds allotted by FWA, C R Hoffman, City Light supt.

Wash., Tacoma—Bids Nov 2, by City, constructing station power and light switchboard for La Grande powerhouse, part second Nisqually power development.

Contracts Let

Alabama—U. S. Eng, U. S. Courthouse & Customhouse, Mobile, awarded contract air conditioning, Montgomery Co, to Engineering Contractors, Inc, Bona Allen Bldg, Atlanta, Ga.

Alabama—U. S. Eng, Talladega, awarded contract constructing improvs and and boiler house, Talladega Co, to Plowden & Roberts, 1420½ Taylor St, Columbia, S. C.

Arkansas—U. S. Eng, P O Box 97, Memphis, Tenn., awarded contract air conditioning bldgs, control towers, Mississippi Co, to Shelby-Skipwith, Inc, 678 Union St, Memphis, Tenn., under $50,000.

Florida—U. S. Eng, Court House, Jacksonville, awarded contract constructing imprvs, Inv Neg Jax 43-280, Hillsborough Co, under $568,000—electrical

PURE ENOUGH TO DRINK...

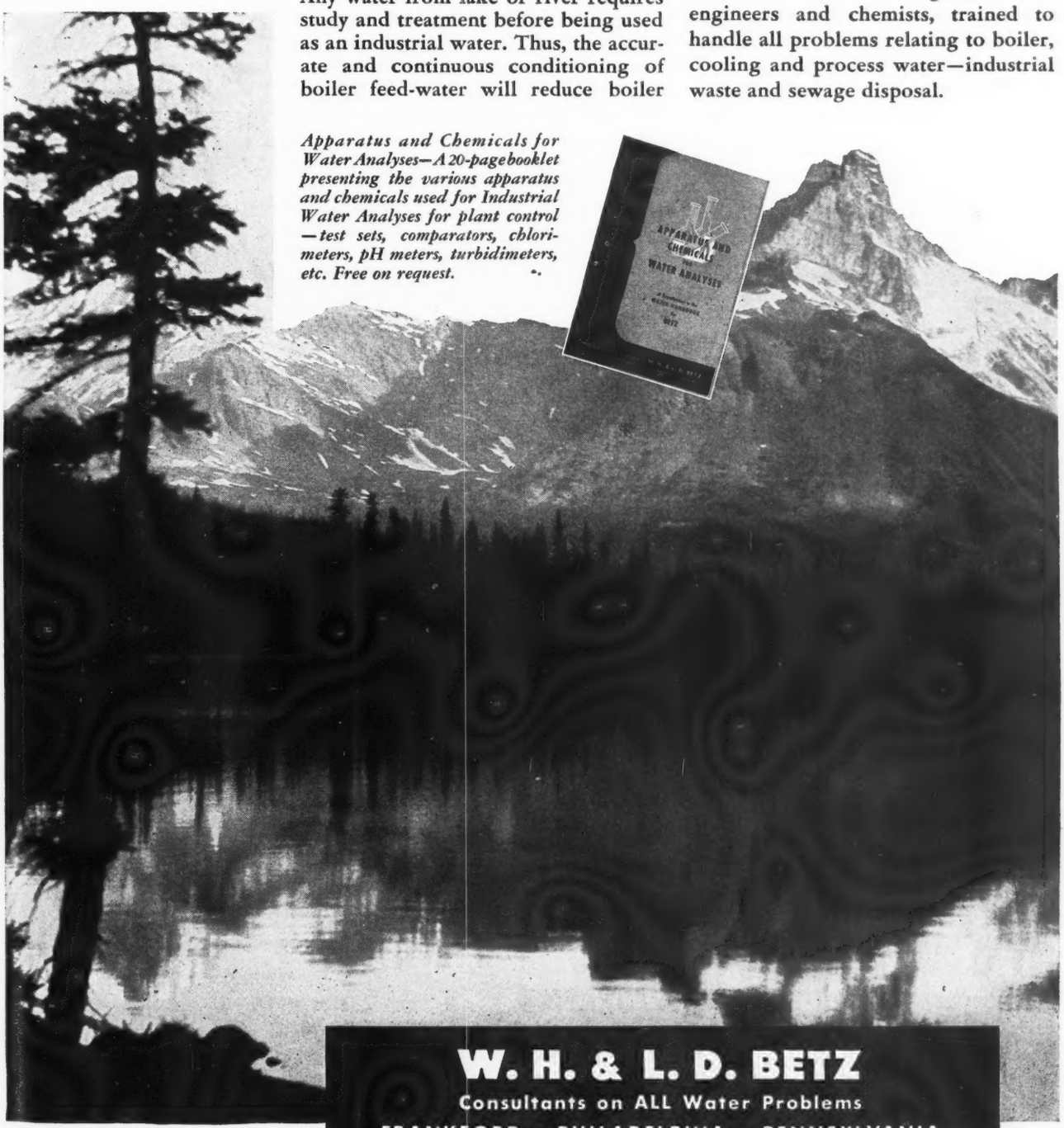
but Unfit for Industrial Use!

Water, clear and sparkling from a mountain lake, may be perfectly potable in its natural state, yet without chemical treatment will be altogether unsuitable for boiler feed. Water demands of industry are sometimes more exacting than those of the human system.

Any water from lake or river requires study and treatment before being used as an industrial water. Thus, the accurate and continuous conditioning of boiler feed-water will reduce boiler outages caused by scale, corrosion and carryover . . . outages requiring costly repairs and resulting in loss of production.

Boiler outages can be prevented through the supervisory services of W. H. & L. D. Betz. Here is an organization of engineers and chemists, trained to handle all problems relating to boiler, cooling and process water—industrial waste and sewage disposal.

Apparatus and Chemicals for Water Analyses—A 20-page booklet presenting the various apparatus and chemicals used for Industrial Water Analyses for plant control—test sets, comparators, chlorimeters, pH meters, turbidimeters, etc. Free on request.



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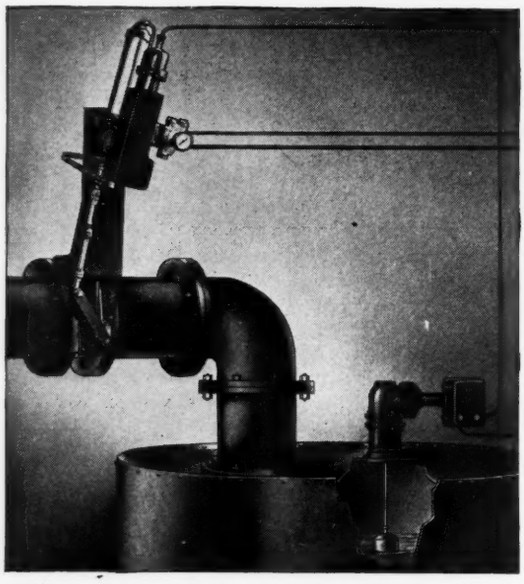
LABORATORIES AND ENGINEERS LOCATED THROUGHOUT U. S. A. AND CANADA

How R-S Butterfly Valves are applied to Liquid Level Control

The Butterfly Valve is controlled automatically by the tank float and is actuated by the hydraulic power cylinder attached to the valve.

The use of an R-S Butterfly Valve as a main control valve *simplifies* the performance of the system because of the minimum pressure drop, unexcelled flow characteristics, wedge-tight shut-off and reduced maintenance. Holds the level within close limits. Used for pressures between absolute and 600 pounds gauge.



R-S Butterfly Valves provide *simplified* control and wedge-tight shut-off of volume and pressure for air, steam, oil and other liquids—in fact, any material that flows or is forced through a pipe. Constructed to withstand high temperatures and pressures to 600 pounds.

Write for detailed information and Catalog No. 10-B.

Direct action float control for low work-

be furnished with counter weight assembly or larger floats as required.

BUTTERFLY VALVE DIVISION

R-S PRODUCTS CORPORATION

4536 Germantown Ave. Philadelphia, Pa.

R-S Streamlined BUTTERFLY VALVES

power sys, Inv Neg Jax 43-282, to Bigby Electric Co, 305 Franklin St, Tampa, under $50,000—air conditioning bldgs, Inv Neg M D 43-6, to Auchors Appliances, Inc, Tampa, Fla., under $50,000.

Florida—U. S. Eng, Court House, Jacksonville, awarded contract constructing cold-storage plant, Inv Neb M D 43-8, Hillsborough Co, to Fred Howland, Inc, Postal Bldg, Miami, under $100,000.

Florida—U. S. Eng, Court House, Jacksonville, awarded contract air conditioning bldgs, Sarasota Co, to Krauss Heating & Ventilating Co, St. Petersburg, under $50,000.

Georgia—U. S. Eng, 494 Spring St, N W, Atlanta, awarded contract constructing boiler plant piping and miscellaneous equip Cobb Co, to Grinnell Co, Inc, 240 N Highland Ave, N E, Atlanta, $100,000-$500,000.

Illinois, Indiana, Ohio and Pennsylvania—War Emergencies Pipeline, Inc, B E Hull, vice pres, Little Rock, Ark., (Cities Service Oil Co, Atlantic Refining Co, Consolidated Oil Corp, Sun Oil Co, Socony-Vacuum Inc, Tidewater Associated Oil Co, Texas Co, Gulf Refining Co, Shell Oil Co, Pan American Petroleum & Transport Co, and Standard Oil Co of N. J.), awarded contract constructing 857 mi 24-in pipeline from Norris City, Ill. to Phoenixville, Pa., to Williams Bros Corp, Natl Bank of Tulsa Bldg, O E Dempsey Const Co, Kennedy Bldg, Anderson Brothers, Tulsa, Okla., Sheehan Pipe Line Constr Co, Natl Bank of Tulsa Bldg, all foregoing in Tulsa, Okla., Oklahoma Contracting Co, Magnolia Bldg, Dallas, Tex., C S Foreman Co, N. Y. Life Bldg, Kansas City, Mo., and Ray E Smith Constr Co, Eldorado, Kan. Est $60,000,000. Defense Plant Corp will finance.

Indiana—U. S. Eng, 612 Federal Bldg, Louisville, Ky., awarded contract constructing imprvs, bldgs, etc, to Thompson Constr Corp, 11 N Pearl St, Albany, N. Y., and 1387 Lincoln Hotel, Indianapolis, Ind. Est over $1,000,000.

Ind., Dresser—Pub Service Co of Indiana, Inc, Traction Terminal Bldg, Indianapolis, awarded contract constructing superstructure generator station, to J L Simmons Co, 715 Union Title Bldg, Indianapolis. Est $150,000.

Ind., Edwardsport—Pub Service Co of Indiana, Inc, Traction Terminal Bldg, Indianapolis, awarded contract constructing power plant addn, to J L Simmons, 715 Union Title Bldg, Indianapolis, Est $500,000. Sargent & Lundy, 140 S Dearborn St, Chicago, Ill., engrs.

Iowa, Boone—Iowa Electric Light & Power Co, Boone, awarded contract constructing power house, to Lippert Bros, Boone. Est $250,000.

Kan., Hays-Walker—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., awarded contract constructing imprvs to W L Johnson Constr Co, Hicksville, O., over $2,000,000.

Louisiana—Industrial company awarded contract constructing imprvs, bldgs, boiler shop, to Chris Larson Co, Maritime Bldg, New Orleans. Est $200,000. J G White Eng Corp, Interstate Bldg, New Orleans, engrs and archts.

Louisiana—U. S. Eng, foot of Prytania St, New Orleans, awarded contract for air-conditioning sys, Inv 43-124, to Equitable Equipment Co, 410 Camp St, New Orleans.

Maryland—U. S. Eng, Standard Oil Bldg, Baltimore, awarded contract constructing pump sta for water supply, Harford Co, to R H Kline, Bloomsburg, Pa., $100,000-$500,000.

Massachusetts—U. S. Eng, 31 St James Ave, Boston, awarded contract construct-

THESE STEEL REEDS are the Heart of all "FRAHM" Instruments

In appearance, these reeds may resemble a paper of matches . . . but there the similarity ends. They are the heart of all Frahm Instruments for measuring speed, frequency and rate of vibration and are the *only* moving parts.

Each reed of the Frahm Instrument, like a pitch pipe, is accurately tuned to a definite period of vibration, and a number of reeds with an appropriate interval between each are grouped in a housing to form a matched set. When minute vibratory impulses enter the reeds through the frame on which they are mounted, individual reeds come into resonance and clearly indicate the frequency of the vibration. Being essentially simple and rugged in construction, and since there are no rotating parts to wear, instrument accuracy is indefinitely maintained.

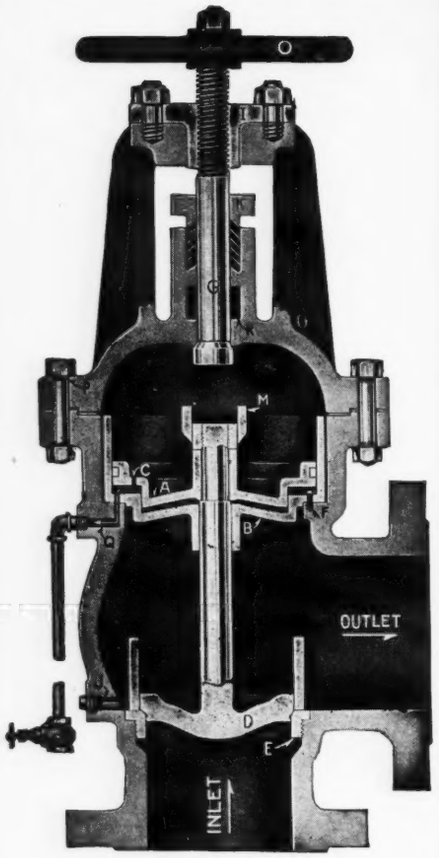
This resonant-reed principle is incorporated in all Frahm Tachometers and Frequency Meters. Instruments are made in both hand and permanent mounting types for speeds or rates of vibration in various ranges between 900 and 30,000 per minute, or frequencies from 15 to 500 cycles per second.

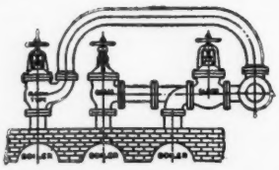
We will gladly send you full details on any or all of these "Frahm" resonant-reed instruments and their applications. The following bulletins are available on request:

Frahm Tachometers, Bulletin 1590W
Frahm Frequency Meters, Bulletin 1695W

James G. Biddle Co.
1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

Golden Anderson SPECIALTY VALVES





NON-RETURN

• A tube bursting in one boiler means that the contents of every boiler in that battery are coming through that rupture *unless* there's a good non-return valve to stop it. To guard against such destruction, install an efficient, non-return valve that *will not* and *cannot* stick — such as the G-A non-return valve shown here. As far as we know, none of the many thousands in use has ever failed.

Safeguard the most valuable thing in the world—human life — with these G-A non-return valves.

WRITE TODAY FOR FREE CATALOG

also

Altitude Control . . .
Pressure Reducing . . .
Throttle and Emergency Stop . . . Check Valves etc.

GOLDEN-ANDERSON VALVE SPECIALTY CO.

FULTON BLDG. PITTSBURGH, PA.

ing mechanical equipment and changes in cold storage bldg, Barnstable Co, to York Ice Machinery Corp, 150 Causeway St, Boston, under $50,000.

Mass., Lynn—Lynn Gas & Electric Co, 90 Exchange St, awarded contract constructing brick, concrete boiler plant addn, Broad St, to Walsh Bros, 150 Hampshire St, Cambridge. Est over $40,000. Stone & Webster, Inc, 49 Federal St, Boston, engrs.

Michigan—U. S. Eng, 700 Union Guardian Bldg, Detroit, awarded contract constructing underground primary service connection to pump house, Macomb Co, to Modern Electric Constr Co, Mt. Clemens, under $1,000,000.

Minn., Duluth—Minnesota Power & Light Co, 30 W Superior St, awarded general contract constructing sub-station, foot 50 Ave W, also 25,000-kw addn steam electric station, to Fulton Constr Co, 1507 Tower Ave, Superior, Wis. Est $2,700,000.

Mississippi—U. S. Eng, U. S. Post Office & Courthouse, Vicksburg, awarded contract constructing steam-generation and steam dist sys, Leflore Co, to S S Richard, Jackson, $50,000-$100,000.

Ohio—Industrial company awarded contract constructing mfg plant, to Turner Const Co, 420 Lexington Ave, New York. Defense Plant Corp will finance.

Oklahoma—U. S. Eng, 416 Wright Bldg, Tulsa, awarded contract constructing bldgs, grading, all underground utilities, except electric dist, to A & B Constr Co, Box 111, Wichita, Kan., $1,000,000-$5,000,000.

Oklahoma—U. S. Eng, 416 Wright Bldg, Tulsa, awarded contract constructing bldgs, Mayes Co, to Long Constr Co, Philtower Bldg, Tulsa.

Oklahoma—U. S. Eng, 231 W Main St, Denison, Tex., awarded contract constructing cold storage plant, Grady Co, to R N Hancock, 102 Heights Blvd, Houston. Est under $50,000.

South Carolina—U. S. Eng, Camp Croft, awarded contract constructing cold storage bldg, Spartanburg Co, to Henry B McKay Co, Greenville.

South Carolina—U. S. Eng, 33 Customhouse, Charleston, awarded contract constructing air conditioning sys, Mecklenburg Co, to Page & Co, 219 S Mint St, Charlotte, N. C.

South Carolina—U. S. Eng, 33 Customhouse, Charleston, awarded contract installing air conditioning and heating sys, Greenville Co, to Reamer Industries, Inc, Seaboard Pk, Columbia, under $50,000.

Tennessee—U. S. Eng, P O Box 97, Memphis, awarded contract constructing electric dist sys and substation, No 1092-43-94F, Lauderdale Co, to Electric Constr Co, 317 Main St, Little Rock, Ark., under $50,000.

Texas and Oklahoma—U. S. Eng, 231 W Main St, Denison, Tex., awarded contract constructing cold storage facilities, to R N Hancock, 102 Heights Blvd, Houston, Tex., and Campbell & Kay, Tyler, Tex., $100,000-$500,000.

Texas—U. S. Eng, Fort Sam Houston, awarded contract air-conditioning sys, Medina Co, to Carrier-Bock Corp, 708 N Harwood St, Dallas, under $50,000.

Texas—U. S. Eng, 231 W Main St, Denison, awarded contract constructing power house for Denison Dam and Reservoir, Red River, Grayson Co, to C F Lytle Co, Denison, $1,000,000-$5,000,000.

Texas—U. S. Eng, Fort Sam Houston, awarded contract constructing over-head steel water tank, 75 ft tower, surface

FREE WAR POSTERS

Since the present series of war poster illustrations started to appear in Wickwire Spencer advertising, requests for them have been pouring in from every part of the country. Because of this wide-spread enthusiasm, the popular poster shown above has now been reprinted with the title which won first prize in a 4-state contest among war-workers. It symbolizes to workmen America's war-*production* spirit.

The painting is by the famous artist, Boris Artzybasheff, whose illustrations appear in Life Magazine, and on Time Magazine covers. The posters are of a convenient size; will fit wherever there is a 30-inch space.

Another Achievement for

WICKWIRE ROPE!

First manufacturer in all New England to be awarded the Maritime M and Victory Fleet Flag for outstanding production accomplishments.

MAIL THIS COUPON

Wickwire Spencer Steel Company,
500 Fifth Avenue, New York, N. Y.

Send.....free posters, "I Pull with Uncle Sam!"

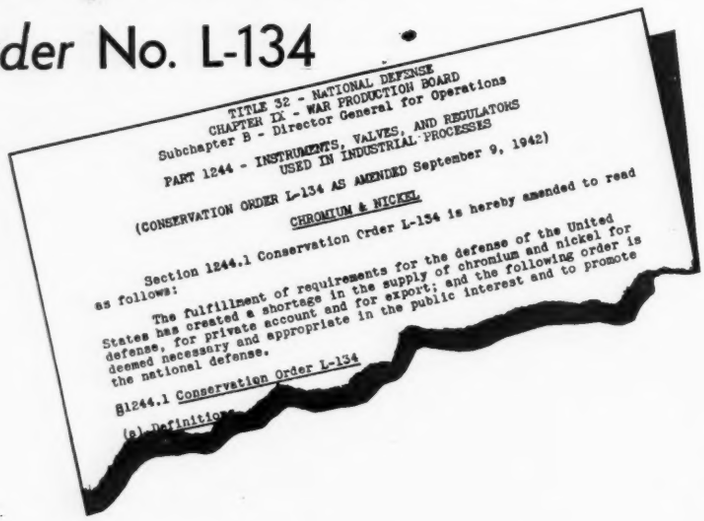
Name.....

Company.....

Address.....

How to CONSERVE *Essential* INSTRUMENT MATERIALS

in compliance with WPB *Conservation Order No. L-134*


TITLE 32 - NATIONAL DEFENSE
CHAPTER IX - WAR PRODUCTION BOARD
Subchapter B - Director General for Operations
PART 1244 - INSTRUMENTS, VALVES, AND REGULATORS USED IN INDUSTRIAL PROCESSES
(CONSERVATION ORDER L-134 AS AMENDED September 9, 1942)
CHROMIUM & NICKEL
Section 1244.1 Conservation Order L-134 is hereby amended to read as follows:
The fulfillment of requirements for the defense of the United States has created a shortage in the supply of chromium and nickel for defense, for private account and for export; and the following order is deemed necessary and appropriate in the public interest and to promote the national defense.
§1244.1 Conservation Order L-134
(a) Definitions

Many valuable solutions to problems arising from the new WPB Conservation Order L-134, which drastically limits the use of various materials for thermocouples, lead wire, thermometer bulbs, protecting tubes, etc., are given in the recently published Wheelco Supplement to Thermocouple Bulletin S2-3. The Supplement S2-3 is the result of an extensive analysis of the WPB Order L-134 by Wheelco Engineers and is published for the benefit of those who will be affected by this order. The Supplement also contains a partial summary of the L-134 Order; the complete L-134 Order as amended September 9, 1942, additions and revisions applying to various items in the Wheelco S2-3 Bulletin and a complete list of Wheelco Sales and Service Engineers who can help you with your instrument problems.

Write for your FREE copy of Supplement to Bulletin S2-3 and the issue of Wheelco Comments which deals with Thermocouple construction and maintenance. Also request copy of Bulletin S2-3 if you do not have a copy.

Wheelco Instruments Co.
863 W. HARRISON STREET • • • CHICAGO, ILLINOIS

Originator of "Electronic Principle" Temperature Controls

concrete water tank, water supply lines, pump house, Val Verde Co, to Williams & Whittle and Williams & Broughton, 5422 Mockingbird Lane, Dallas, $50,000-$100,000.

Texas—U. S. Eng, Fort Sam Houston, awarded contract constructing summer-winter air conditioning sys, electric wiring, Spec 42-271, Val Verde Co, to Harris & Beeman, Inc, 509 E 3 St, Fort Worth, under $50,000.

Wisconsin—U. S. Eng, 408 Federal Bldg, Milwaukee, awarded contract constructing steam generation, steam dist, steam heating, steam utility, condensate return and ventilation sys, Milwaukee Co, to Downey Heating Co, 1712 W St Paul Ave, Milwaukee, under $50.000.

Engineers' Books

(*Continued from page* 138)

a long way toward producing a text that meets their specifications. A text of its size is probably too extensive for many college courses. This problem has been simplified by the arrangement of the material so that part of it can be readily omitted. The subject matter has been divided into eleven main divisions: synchronous generators, transformers, polyphase induction motors, single-phase induction motors, synchronous motors, alternators in parallel, synchronous converters, mercury-arc rectifiers, series motors, repulsion motors and 173 problems. Each subject is treated somewhat in the following order: construction, discussion of operating characteristics; calculation of operating characteristics from tests and discussion and analysis of various phenomena. In general the scope and character of this edition have not been changed from those in its predecessor, but the text has been revised wherever necessary to bring it in line with changes in theory, practice and standards that have occurred during the last six years. Even though written for a college text the treatment is such that the practicing electrical engineer will find this book a valuable reference.

Plastics

PLASTICS FOR INDUSTRIAL USE (1942). *By John Sasso, Associate Editor of Product Engineering. Published by McGraw-Hill Book Co, 330 West 42nd St, New York, N. Y. 229 pages, 6x9 in., illustrated. Price $2.50.*

Plastics can do duty as substitutes for strategic metals, but they also possess certain inherent characteristics and advantages of their own. This book lists properties of modern plastics that aid in selecting the right material for strength and performance. While the

Re-Line Your Boiler, Too

AN APEXIOR LINING ON WORN BOILER METAL GIVES INDEFINITE SERVICE

A new lining for your brakes to take the punishment and provide safe efficiency is only common sense.

Today, old, but irreplaceable steam boiler equipment — some of it almost ready to be condemned — is being re-lined with APEXIOR — to make the metal last for years to come.

Any boiler that passes the required hydrostatic test when cleaned, can be kept in operating condition indefinitely with APEXIOR protection.

APEXIOR — the Long-Wearing, Renewable Lining for Tubes and Drums

APEXIOR No. 1 is an easily applied protective coating that seals the bare metal against corrosion and direct wear. The new surface takes it all. Scale cannot form a tight bond with APEXIOR — and is quickly removed with a wire brush.

The APEXIORIZED surface lasts 2-3 years or more. And it is easily renewable, with a hand-brush or power coater, to keep the original metal intact.

APEXIOR guarantees good metal condition . . . no other protection offers the same assurance and security

Long-time users of APEXIOR know it as a supplementary protection along with chemical feedwater treatment, helping them maintain long life and most efficient operation for steam boiler equipment.

Present conditions make it mean far more than this . . . a *necessity* in keeping old and new equipment going for the duration.

Write for Bulletin 1290

Recommended by all U. S. and Canadian boiler insurance companies.

APEXIOR
REG U.S. PAT. OFF.

THE DAMPNEY COMPANY OF AMERICA

PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

HYDE PARK · BOSTON · MASSACHUSETTS

Atlanta Chicago New York Detroit Philadelphia

Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manila, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

ROTO Offers You a Complete Boiler Cleaning Kit

Get every tool you need to clean your boilers quickly and thoroughly by ordering a complete Roto boiler cleaning kit. We can supply you with air-, steam- or water-driven motors for various sizes and shapes of tubes, and the proper types of heads for your particular kind of deposit.

This kit can also contain a Roto Pneumatic Scaling Hammer for chipping scale from drums and flat surfaces. We can furnish a wire brush with universal joint for polishing tubes after scale removal, and a brush adapted for direct connection to the motor for polishing insides of drums and outside surfaces.

If you will describe your equipment and nature of scale, we will gladly recommend a Roto boiler cleaning kit to do the entire job properly.

The ROTO Company
145 Sussex Avenue
NEWARK, N. J.

Model 130 air-driven cleaner for 3¼" curved tubes, with air valve for one-man operation.

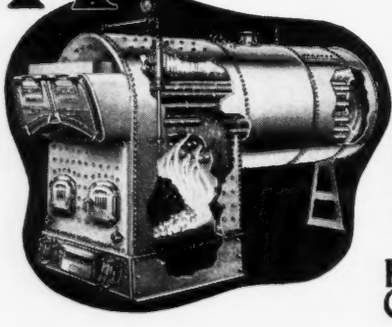
Pneumatic scaling hammer, furnished with flat chisel, star drill and hose.

Wire cleaning brush with universal joint.

Wire cleaning brush with adapter.

Extra Strength . . . for Heavy Duty

KEWANEE



FIRE BOX BOILERS

Every characteristic which makes firebox type boilers especially adaptable for Hi Pressure Steam will be found in Kewanee Heavy Duty Series. Sizes for 4 to 300 Horse Power . . . 100, 125 and 150 lbs. W.P.

For 6" rule with scale for outside diameter of pipes, write Dept. 96K-XII

KEWANEE BOILER CORPORATION Kewanee, Illinois

emphasis, of course, has been placed on casting and molding methods as applied to production of plastic parts, such interesting and informative data has been collected on present-day application to such items as cams, electric insulation and even stirrup pumps. Data on cutting tools and machining are given.

Paint

NATIONAL PAINT DICTIONARY (Second Edition—1942). *By Jeffrey R Stewart, editor and publisher of the National Paint Bulletin. Published by Stewart Research Laboratory, 1340 New York Ave, N.W., Washington, D. C. 216 pages, 9x12 in., 250 illustrations. Price $7.50.*

A handy explanation in technical terms of names of chemicals, raw materials, testing equipment and apparatus used in the paint industry. Compiled information alphabetically arranged for the use of specification writer or purchasing agent, particularly valuable for reference to trade names and manufacturers in the paint manufacturing field.

Power Lines

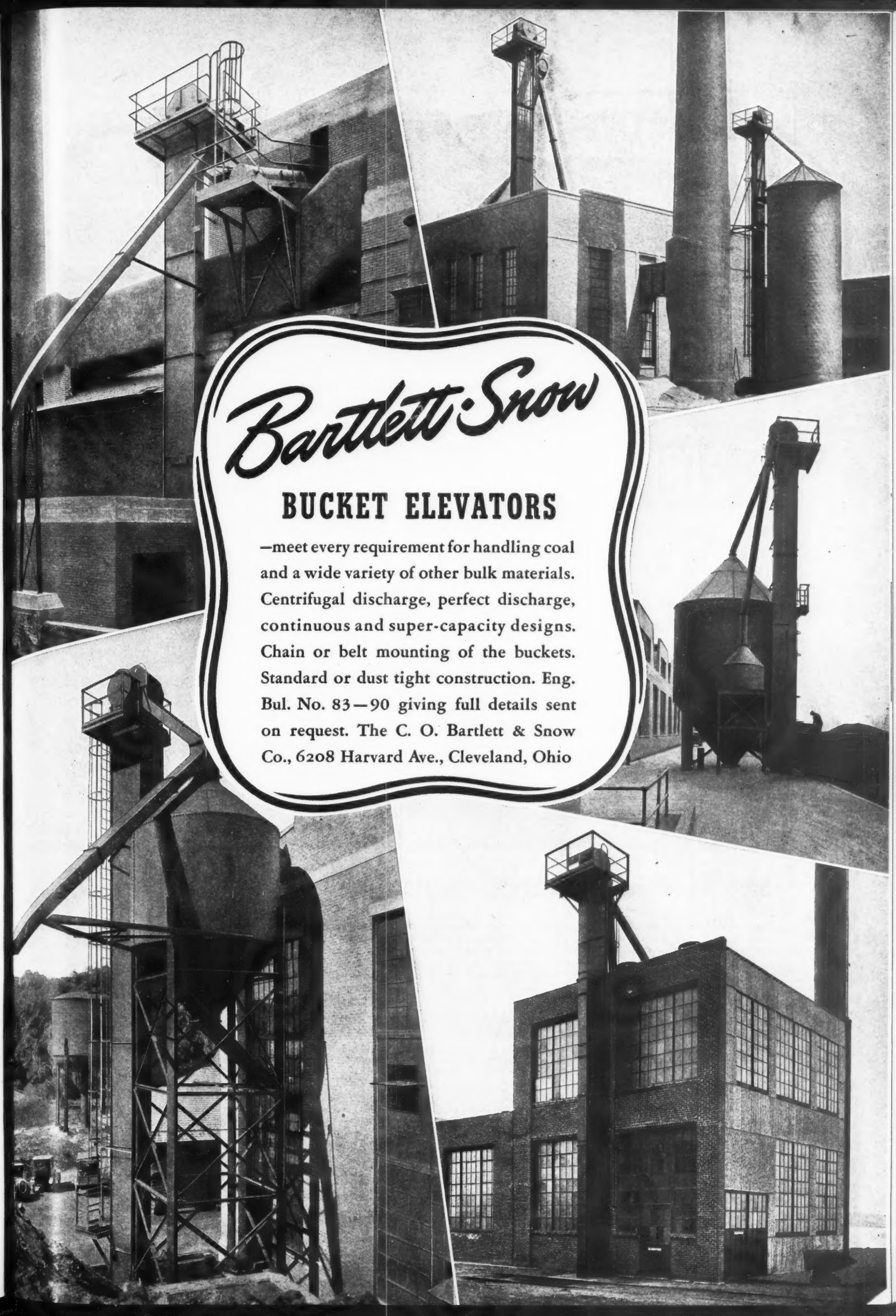
(*Continued from page* 132)

Honan-Crane Corp, Lebanon, Ind. Mr Defibaugh comes to Honan-Crane from the Globe American Co, of Macomb, Ill., where he has been works manager for the past seven years. He will supervise the company's expanded manufacturing program.

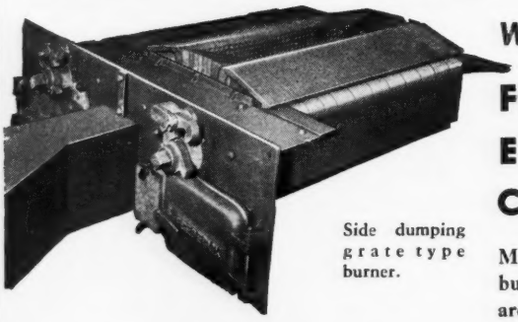
WENDELL J WRIGHT has been elected a director of the Public Service Corp of New Jersey and a member of its executive committee. Mr Wright has been general counsel of Public Service and its subsidiary companies since 1933. He joined the Public Service law department in 1926.

W J SIMPSON, a graduate engineer of Pennsylvania State College and for several years design engineer for Baldwin Locomotive Works, Baldwin-Southwark Corp, and Brill Car Co, has joined the engineering staff of Milton Roy Pumps, Philadelphia, Pa.

E P BARRY has been appointed coordinator of plants for the Chicago Pneumatic Tool Co. Mr Barry will supervise machine equipment, tool designing and production methods for the four company plants.


Bartlett-Snow
BUCKET ELEVATORS
—meet every requirement for handling coal and a wide variety of other bulk materials. Centrifugal discharge, perfect discharge, continuous and super-capacity designs. Chain or belt mounting of the buckets. Standard or dust tight construction. Eng. Bul. No. 83—90 giving full details sent on request. The C. O. Bartlett & Snow Co., 6208 Harvard Ave., Cleveland, Ohio

FULL ACTIVE GRATE SURFACE



Side dumping grate type burner.

Without dead plates

FOR MAXIMUM EFFICIENCY IN COMBUSTION!

More grate area with low combustion rate per square foot of area! . . . Frederick Stokers have specially designed tuyeres with air ports so arranged and proportioned as to insure correct air distribution and maximum efficiency in combustion. Enclosed wind-boxes with two cleanout doors, another exclusive Frederick feature, eliminate possible air leakage through brickwork . . .

YES, NEW FREDERICK STOKERS *ARE* DIFFERENT. A long list of original features distinguish them; many common stoker problems are solved by them. We suggest you write for complete description. Just send a note on your letterhead.

Frederick
INDUSTRIAL
STOKERS

The FREDERICK IRON & STEEL CO.
FREDERICK, MARYLAND

Complete Line of Centrifugal Pumps for All Purposes
*Steam Operated Ash Conveying Systems**
Ash Storage Bins

XZIT

frees scale and soot from your boilers

FIRE SCALE AND SOOT ERADICATOR

Step up efficiency without shutting down

Now is the time to clean your boilers with XZIT and save time, labor, money and fuel—now when every extra pound of steam capacity is necessary to meet the "all out" demand for power.

Xzit FIRE SCALE and SOOT ERADICATOR provides a simple way to keep boiler heating surfaces clean even though you may be forced to use lower grade fuels. This scientific combination of chemicals, spread over a hot coal bed or through peep hole of an oil-fired furnace loosens or dries the binder out of soot and scale making it easily removed. Continued use of Xzit prevents further formation of scale.

Xzit also cleans uptakes breechings and stacks. It is harmless to metal or brickwork. Its efficiency depends on use while boiler is hot and is applied while boilers are in regular operation. Xzit has been tried and proved in all types of boilers.

INVESTIGATE TODAY

Write for full information. Let us answer your questions about XZIT and show you how easy it is to use.

•

Openings are available for sales representatives in a few desirable territories.

XZIT SALES COMPANY
1031 CLINTON STREET **HOBOKEN, NEW JERSEY**

DON G MITCHELL has been named vice-president in charge of sales of the Sylvania Electric Products, Inc. This is a new office, established to plan and direct the distribution and merchandising of all Sylvania products. Don G Mitchell was formerly vice-president in charge of sales of the Pepsi-Cola Co, and previous to that had been with the American Can Co.

DR WILLIAM M WHITE, internationally known engineer and manager of the hydraulic turbine department of the Allis-Chalmers Mfg Co, has announced his retirement. Dr White, in thirty-one years with the firm, engineered some of the largest hydro-electric installations in the world, including Niagara Falls, Boulder Dam and TVA. He came to Allis-Chalmers in 1911.

RUSSELL G DAVIS has been elected to the vice-presidency of the Foote Bros Gear & Machine Corp, Chicago, Ill. Mr Davis will continue in his capacity as general manager of the industrial gear division.

SELDEN H GORHAM has been appointed manager of sales of the Allis-Chalmers Mfg Co. Gorham has been identified with the Allis-Chalmers sales organization since 1933, his initial post being with the Detroit office as a representative of the feed water treating department. For the past six years he has been in charge of sales and production for that department.

GEORGE L RANDALL has been appointed public relations manager of the Wickwire Spencer Steel Co. Mr Randall has been with Wickwire Spencer for the past seven years, the last of which as advertising manager. In addition to his new assignment, Mr Randall will continue in charge of advertising.

"BOB" A ORNBERG has recently been appointed advertising manager of American-Marietta Co, Chicago. Mr Ornberg, for the past three years, was connected with Curtis Lighting, Inc.

Having acted in the consulting capacity since April, 1942, for the Wainwright Yard of the J A Jones Construction Co at Panama City, Fla., WILLIAM M KENNEDY has accepted a position as assistant general manager in complete charge of ship construction with that yard. In order to devote his entire time to this shipbuilding activity, Mr Kennedy has withdrawn from Condenser Service & Engineering Co, Inc. In connection with the withdrawal of Mr William Kennedy from the company, the

Son...

HE has just turned eighteen. Shaves twice a week and maybe a hair or two is sprouting on his chest. He shies away now when his dad tries to be affectionate and we noticed some lipstick on one of his handkerchiefs after a country club junior dance not so long ago. But it seems only yesterday, perhaps it was the day before, that he was a chubby legged kid swinging from the arch of the doorway, leading to the dining room, in a gadget that was something like a breeches buoy and he was sucking at the end of a turkey bone.

He went back to school this Fall, a tall, athletic lad, budding into manhood, but there was something else on his mind beside the football and hockey teams or the little blonde girl with whom he had "palled" around during the Summer. It seems as though he was listening for a certain call—the Clarion call that poets sing about—and, perhaps we just imagined it, but we thought we saw an upward jutting of his chin, a certain light in his eyes, and a sort of a rearing-to-go expression in his face.

It chilled us a bit in the region of our heart, when we thought of his discarding the sports coat for the "O.D." of the Army or the blue of the Navy. There was a bit of a catch in our throat as we thought of his putting aside his football helmet for one of steel; of his hanging up his hockey stick and reaching for a gun. After all we still regard him as just a little boy.

They tell us that the eighteen and nineteen year old lads are to be called to the service. When that day comes to us there will be prayers, but no tears. We shall not mourn nor shall we be fearful. Rather there will come welling up from our hearts that warm feeling of pride that millions of other parents will sense when their beloved lads marched away. Our lad is no different than the others. We are no different than other loving parents, nor is our sacrifice any greater. They are going to make great soldiers, sailors, marines and fliers out of these youngsters. And they will become a mighty force when they take their places beside their brothers in arms. They too know what they fight for. They too know full well of the sacrifices that must be made before the evil powers that threaten the world can be overcome.

And let us not forget that they are counting on us. They know that we shall not fail them.

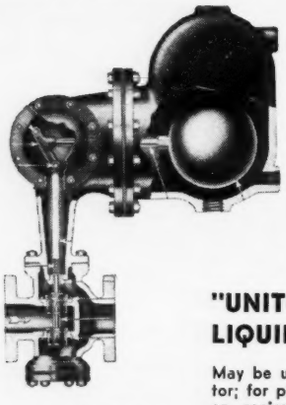
God be with them and their brothers.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.
REG. U. S. PAT. OFF.

K & M
LIQUID LEVEL CONTROLS since 1879

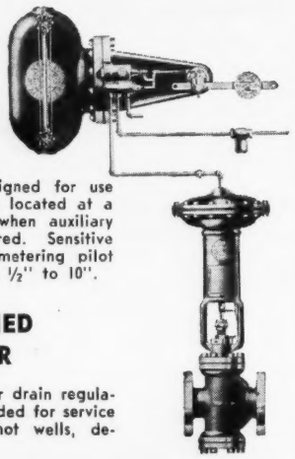
We're "ALL OUT" so the AXIS will be "ALL IN" Please bear with us for the duration —

Kieley & Mueller has been manufacturng precision controls for 63 years. This long specialized experience is behind K&M Liquid Level Controls which are designed to meet the most exacting requirements of present day service. The units shown here are typical of those included in the complete K&M line.



"REMOTROL" PILOT OPERATED LIQUID LEVEL CONTROLLER

A precision pilot control designed for use on applications where valve is located at a distance from float cage or when auxiliary controlled main valve is desired. Sensitive operation assured by special metering pilot and pilot linkage. Valve sizes: ½" to 10".



"UNITROL" SELF-CONTAINED LIQUID LEVEL CONTROLLER

May be used either as a feed regulator or drain regulator; for pressures up to 250 lb. Recommended for service on recirculating systems of condenser hot wells, deareators, etc. Valve ½" to 4".

KIELEY SINCE 1879 MUELLER

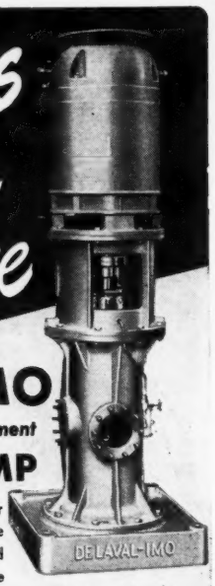
KIELEY & MUELLER

General Offices and Factory

2013-2033 — 43rd Street, North Bergen, N. J.

Reducing Valves — Liquid Level Controls — Float Valves — Pump Governors — Strainers — Control Specialties.

Saves floor space



The De Laval-**IMO** *Rotary Displacement* **OIL PUMP**

has neither valves nor gears and can be driven by a standard speed motor or turbine or coupled directly to some part of the machine served. The unit shown is a marine lube oil service pump. It delivers 600 g.p.m. and requires only 18 inches square floor space. Other models are available for bulkhead mounting or submerging in the oil tank. IMO pumps handle any grade of oil, in any volume and against any pressure.

IMO 1 MOVE OIL

Ask for Leaflet I-99

IMO PUMP DIVISION

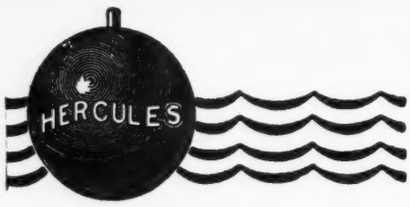
of the De Laval Steam Turbine Company

Trenton, New Jersey

HERCULES

Seamless Copper

FLOATS



GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS

200 Franklin St.

SPRINGFIELD, MASS.

regular personnel will carry on its business as heretofore.

BUSINESS ITEMS

B F Sturtevant Co, Hyde Park, Boston, Mass., announces the opening of a new branch plant at La Salle, Ill. The new plant will serve as the company's Mid-West production center, superseding the factory at Sturtevant, Wis., which has been closed.

Water Treatment Co of America, Pittsburgh, Pa., announces the appointment, as distributor for Technical Water Conditioning System, of Bailey Farrel Co. The new distributor has offices in Charleston, and Huntington, W. Va., both of which will handle the system.

Kieley & Mueller, Inc, in its 63rd year, has expanded its factory to triple the size of its former plant. The new factory and general offices, including properties, cover a whole city block at North Bergen, N. J.

Union Iron Works announces that there have been some changes in the officers of the company. E T Knobloch is now president and general manager; R E Sevis is vice-president and sales manager; E E Knobloch is treasurer, and O E Henning, secretary.

In the interest of industrial conservation, and to help speed war production, Metallizing Engineering Co is offering a total of $650 in War Bonds for details of maintenance and salvage procedure with the metal spraying process. Complete information obtainable from Metco News, 21-07 41st Ave, Long Island City, N. Y.

Bird-Archer Co has announced removal of its Chicago office from 2030 North Natchez Ave to the Wrigley Building.

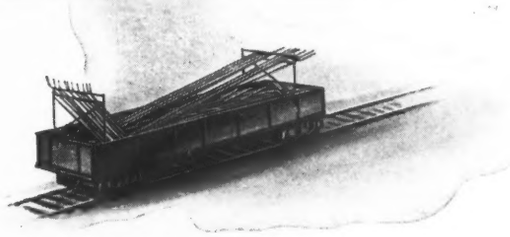
Westinghouse Electric & Mfg Co announces several personnel changes. B O Austin has been appointed control section engineer, with responsibility for design and development of certain war equipment at the Lima, Ohio, small motor division of the company. Neil C Reed has been named supervisor of the sales negotiation section on the principal war products of the plant. Charles F. Wagner and Dean Harvey have been honored by company for outstanding contributions to the electrical industry. Both were awarded the Westinghouse

Order of Merit, voted to employees by the company's board of directors in

A hundred thousand tube-miles of B&W experience

Experience gained by The Babcock & Wilcox Tube Company in manufacturing and distributing more than one hundred thousand miles of seamless steel boiler tubes is inherent in all B&W Tubes—apparent in the quality and dimensional accuracy of the tubes received—in the competent, complete service performed by B&W Tube Distributors.

The Babcock & Wilcox Tube Company, closely allied with the world's largest boiler manufacturer, devotes its entire capacity to the production of specialty tubes rather than tonnage products—an additional guarantee that, even under the stress of war needs, the quality of B&W Seamless Steel Boiler Tubes is maintained.



Finally, B&W Tube Distributors are strategically located in thirty-three industrial cities.

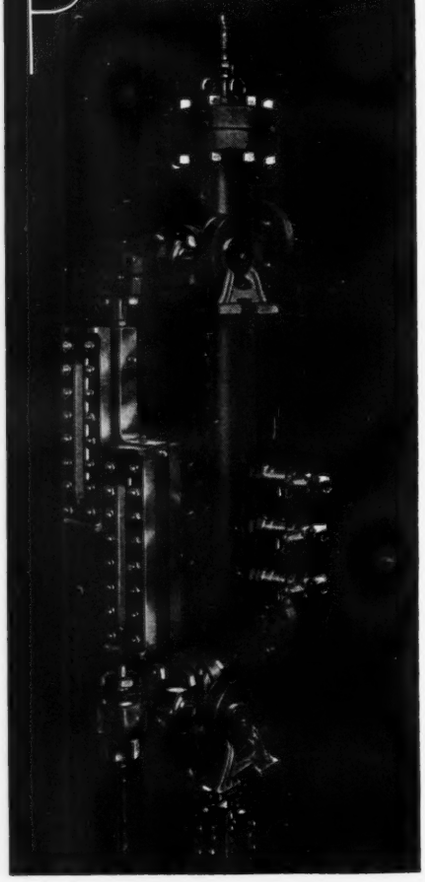
BABCOCK & WILCOX TUBES

HOT FINISHED ALLOY STEELS
COLD DRAWN CARBON STEELS

THE BABCOCK & WILCOX TUBE COMPANY
BEAVER FALLS, PA.

TA-1213

POSITIVE
Protection



Yarway's unique Hi-Lo Alarm mechanism utilizes balanced *solid weights* that are as indestructible and unchanging as the metal itself. Operating on the displacement principle, they literally "weigh the water level."

When the high or low water emergency occurs—instant, positive, powerful, hair-trigger *action* results—giving warning of danger by whistle, light, or both.

Yarway Water Columns, eight standard models, iron bodies with screwed connections for pressures up to 250 lbs., forged steel bodies with flanged connections for pressures up to 1500 lbs., are fully described in Catalog WG-1809. Write for a copy and working model.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY
FLOATLESS HI-LO ALARM
WATER COLUMN

recognition of meritorious service. Mr Wagner, manager of central station engineer at the East Pittsburgh Works, was honored for his lightning studies which have won him international fame among engineers. Mr Harvey, materials and standards engineer at East Pittsburgh, was cited for his contribution to the war effort as a member of the Conservation Commission of the War Production Board. Harry F Boe, manager of the company's district repair and manufacturing department, was elected to the vice-presidency by the board of directors. As manager of the Westinghouse District Repair and Manufacturing Department, Mr Boe directs the largest industrial organization of its kind in the country, supervising the operations of 35 plants located in strategic industrial centers from coast to coast.

General Electric Co announces: H J Mandernach has been appointed sales manager of the replacement tubes section of the Radio, Television & Electronics Department at Bridgeport, Conn. Charles Amo, an instructor in the Screw Machine Department of the Schenectady Works has just completed 50 years' service without a lost-time accident. K R Van Tassel has been appointed manager of sales of the newly-formed integral-horsepower motor section of the motor division. D A Yates, of the same division, has been placed in charge of the Lynn Motor Group at G-E's Lynn Mass., plant. J L Townsend has been appointed assistant manager of sales, fractional horsepower motor section of the motor division.

In the ★ Service

From information received during the past month, Power *here presents a brief summary of power men who have left their business positions to enter the armed services:*

Lawrence E Skelly, from Young Radiator Co to Lieutenant (Jg) U. S. Naval Reserve.

Louis H Brendel, from manager of jobber distribution, Manning, Maxwell & Moore, Inc. to Lieut Commander, U. S. Navy.

in all

hands

Laminum shims place quick *precision* in the hands of every assembly and maintenance man. (.003 or .002 in. brass laminations bonded together and easily peeled.) Cut to your specifications.

Stock shim materials obtainable from your mill supply distributors. (Write us for sample and illustrated application chart.)

Laminated Shim Company
Incorporated
61 Union Street Glenbrook, Conn.

it's
LAMINUM
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

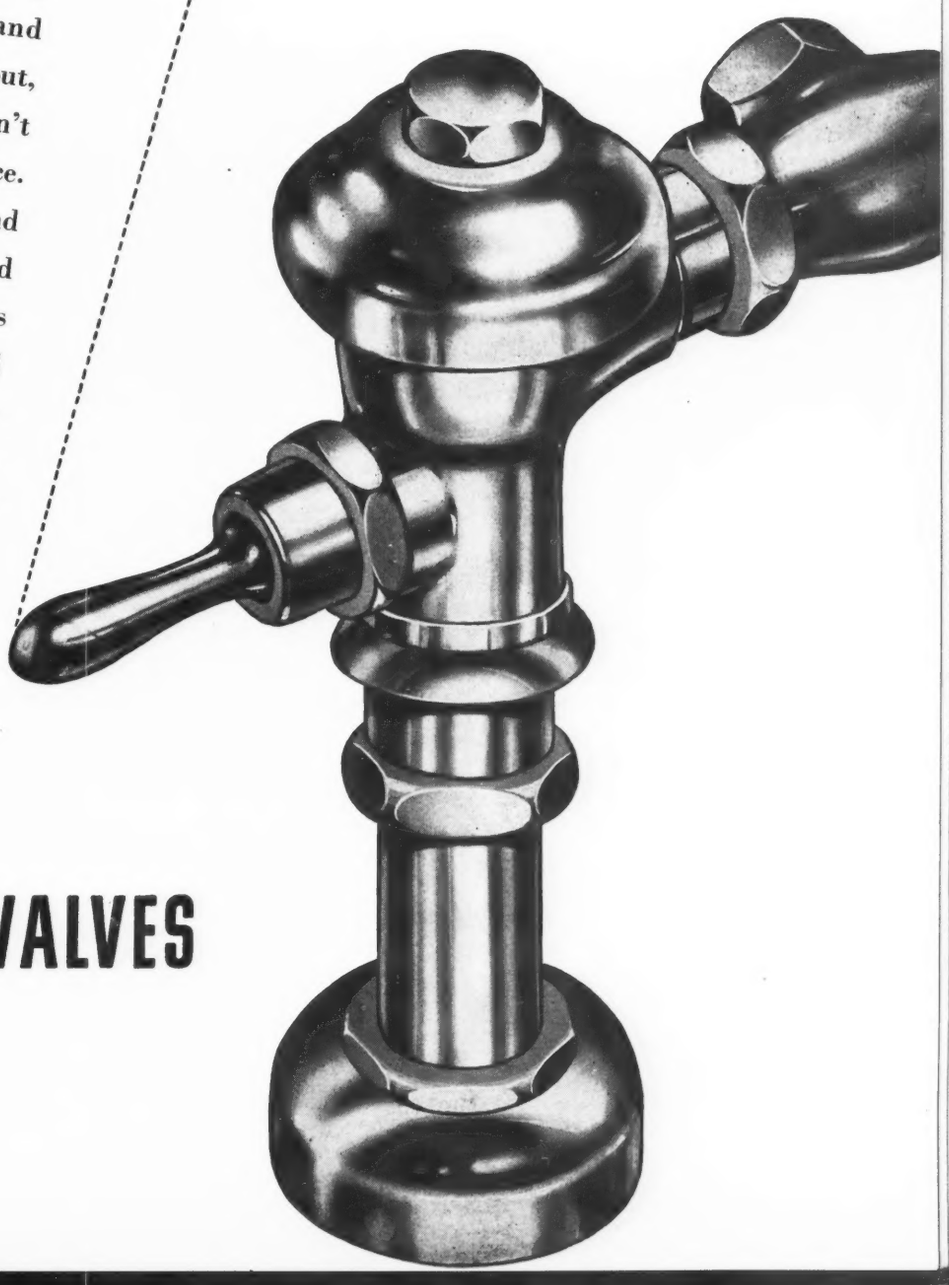
They rarely need attention... BUT they deserve it now!

In these days of shortages it behooves all of us to conserve that which we have. Rarely do either your automobile tires or your Sloan Flush Valves need attention, but since everything entering into their manufacture is on the critical list, they deserve it now.

Just because your Sloan Flush Valves operate so efficiently and trouble-free, year in and year out, don't take them for granted. Don't overlook their proper maintenance. Call in a master plumber today and have your Sloan Flush Valves checked over. He will make only those repairs which are necessary, and you will then have the assurance that your every Sloan Valve is again as good as new, ready for more long years of trouble-free service.

Conserve vital materials by proper maintenance.

SLOAN VALVE COMPANY
★ ★ 4300 West Lake Street, Chicago ★ ★



SLOAN FLUSH VALVES

DIESEL POWER

WITHOUT
EXHAUST RACKET

Maxim Silencers on the exhaust or intake of Diesel engines cut down noise and pulsation to a minimum without in any way affecting the efficiency of the engine's operation.

●

Effective silencing has a provable effect on work efficiency within the plant itself. In addition, it makes possible night or day operation without creating a disturbing noise situation for neighbors who may be trying to sleep while you work.

●

More and more Diesels are being used in what we call "critical" installations: hospitals, hotels, department stores, etc. where undue exhaust noise would make the use of the equipment entirely impossible. Here too Maxim Silencers provide a simple, efficient answer by reducing such exhaust noise to a whisper. Consult The Maxim Silencer Company, 92 Homestead Ave., Hartford, Conn. for a solution to your particular problem.

MAXIM
SILENCERS

Valuation Society To Meet Dec. 12

The Technical Valuation Society, Inc, will hold its annual forum on Dec 12, 1942, in New York, N. Y. The morning session will be devoted to prominent economists, appraisers and valuation engineers who will present papers and direct discussions on many pressing valuation problems, particularly in their relation to the war effort. The afternoon session will consist of committee meetings and the annual business meeting of the society. Further information can be obtained from W C Fisher, chairman of the program committee, The Technical Valuation Society, Inc, 33 West 39th St, New York, N. Y.

Production Scheduling Power Equipment

Procedures for the production scheduling of heavy power and steam equipment are established in Amendment No. 4 to Limitation Order L-117, issued Nov 2 by the War Production Board. Manufacturers of power equipment will submit monthly reports covering existing production schedules. These schedules will be reviewed and, if necessary, revised by the War Production Board.

Production scheduling has been devised as a means of reconciling the heavy demand for power equipment with the limited production facilities of the industry. Production schedules must be so arranged as to assure delivery of large items of power equipment in time to meet the requirements of our national power program. Furthermore, since a single power installation may require many items of equipment produced in separate manufacturing plants, it is important to integrate the delivery dates of such items.

The new amendment extends to a variety of power equipment controls similar to those which now apply to power turbines under an earlier War Production Board order. Among the items of equipment covered by the amendment are large steam-generating boilers, steam surface condensers, steam engine-generator units, frequency changers, synchronous condensers and transformers.

Overmotoring Almost A Crime, Says Umansky

"When in doubt consider the next smaller rating" is a slogan that might well describe General Electric's cam-

NEED A NEW DOOR LINING *or* **SPECIAL REFRACTORY SHAPES... *FAST?***

***Cast them yourself... FAST. Use a Castable Refractory made with* LUMNITE!**

IF YOU'RE in a hurry to replace a door lining, arch, baffle, burner block, or some special refractory shape, you can do it quickly with a Castable Refractory.

Pour the dry castable mixture out of the bag and mix it with water right on the job. The resulting Castable Refractory, poured in a form to make jointless one-piece walls or arches, or placed in a home-made mold to get a precast shape, is ready for service 24 hours after mixing. No waiting... no delay... no production time out.

A Castable Refractory handles as easily as ordinary concrete. There's no cutting or fitting... no ramming... practically no shrinkage in drying or firing. It's not affected by steam or moisture. Has high resistance to spalling. Can be stored indefinitely.

Specify Castable Refractories made with LUMNITE, and you get a balanced, always uniform product, made with carefully selected aggregates and the hydraulic binder which made Castable Refractories possible. Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors.

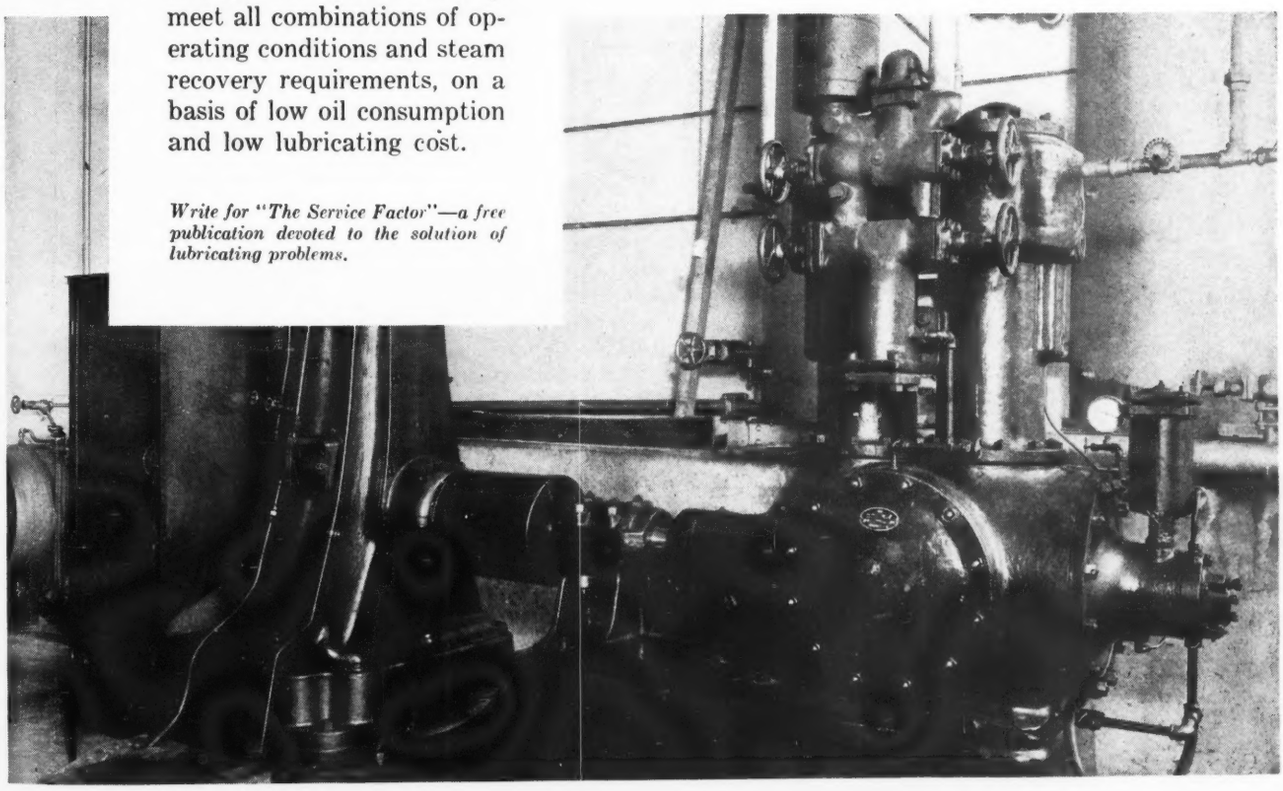
The Atlas Lumnite Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Bldg., New York City

Specify **CASTABLE REFRACTORIES MADE WITH LUMNITE**

REPLACEMENTS are as big a problem *at home* as at the Front. Avoid replacement problems and preventable shutdowns in *STEAM* plant operation by using . . .

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils correctly meet all combinations of operating conditions and steam recovery requirements, on a basis of low oil consumption and low lubricating cost.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

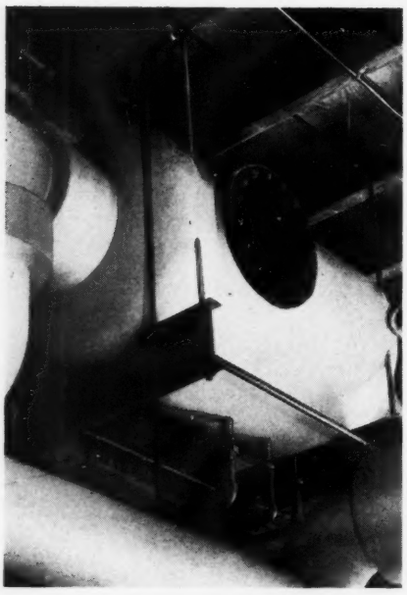


SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth



Cochrane Exhaust Steam Purifier located between 150 h. p. engine and coil of hot water generator.

COCHRANE PURIFIERS PROTECT & IMPROVE THE EFFICIENCY OF BOILER PLANTS

(on inlet side of prime mover)

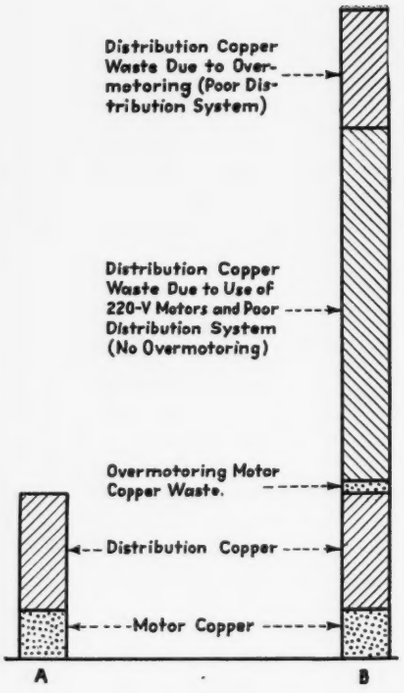
- by removing dirt and moisture from steam.
- by preventing slugs of water from wrecking turbines, engines and pumps.
- by making it possible to drive boilers at higher ratings.

(on exhaust side of prime mover)

- by removing oil and water from exhaust steam, making it usable for boiler feed or process work.

Write for Publication 2725

COCHRANE CORPORATION
3106 N. 17th St., Philadelphia, Pa.


Distribution Copper Waste Due to Overmotoring (Poor Distribution System)
Distribution Copper Waste Due to Use of 220-V Motors and Poor Distribution System (No Overmotoring)
Overmotoring Motor Copper Waste.
Distribution Copper
Motor Copper
A
B

paign to point out how materials can be conserved and motor production increased through the selection of motors closer to their ratings for specific jobs. L A Umansky, assistant manager of the company's industrial engineering department, sounded the keynote of this campaign in a recent statement.

Mr Umansky pointed out that because of "overmotoring" up to 25% more material and labor are now going into the production of motors than is needed for the work they are called upon to do. "Motor users and specifiers can help greatly in conserving critical materials and in helping motor manufacturers produce the maximum number of motors needed to win the war," said Mr Umansky, "by selecting the motor size on the basis of the actual expected duty without overstress on additional safety factors to take care of unexpecedly heavy loads or to lengthen motor life."

"Conservatism in motor selection, however commendable in normal times, must be discarded for the duration," said Mr Umansky. "Although modern motors are considerably lighter for the same horsepower than those of a few years ago because of better available materials, they are just as conservatively rated by the manufacturer who has already designed into them a margin of safety to meet reasonable overloads."

Mr Umansky pointed out that "overmotoring" also affects almost everything else in a plant's electric chain including control, distribution, and generation since the capacity of the power system is very often based on the installed

Is your Business carrying a fever?

Check the temperature at which your place operates with those on this chart. See what can be done with proper refrigeration. Perhaps your business should be carrying a lower temperature.

°F
80 Summer air conditioning
75 Cooled swimming pools
70 Winter air conditioning
65 Chocolate dipping rooms
60 Banana ripening rooms
55 Cold water for process work
50 Cold drinking water
45 Chilled water for air condit.
40 Storage of cheese, nuts, etc.
36 Short term food storage
35 Water for carbonation, etc.
32 Beef chill rooms
30 Long term apple storage
28 Ice storages
25 Oleomargine, skins, etc.
20 Chilled brine for processing
15 Brine for freezing ice
10 Frozen fish
5 Frozen meats
0 Locker rooms
-10 Freezers for raw cream
-15 Freezers in locker plants
-20 Commer'l quick-freezers
-25 Condensing gasoline
-30 Hardening ice cream
-40 Testing guns & radios
-50 Blizzard freezers
-70 Testing tanks
-80 Air for liquefying
-100 Research work
-110 Dry ice temp.

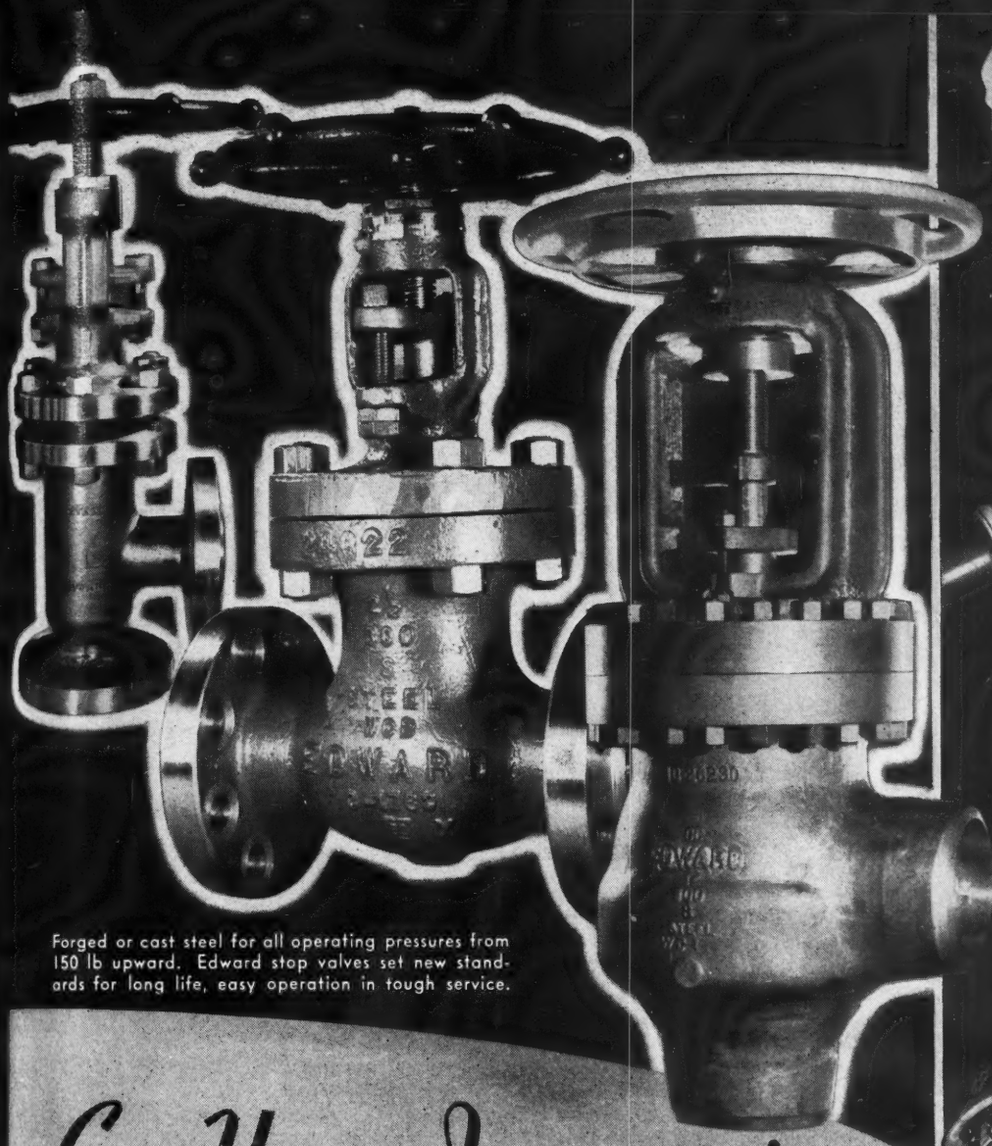
Ethylene liquefies -155
Natural gas liquefies -255
Oxygen liquefies -298
Liquid air temp. -315
Liquid Nitrogen -321
Liquid Neon -411
Liquid Hydrogen -423
Liquid Helium -452
Lowest temp. reached -459.4
Absolute Zero -459.6

TRADE FRICK MARK

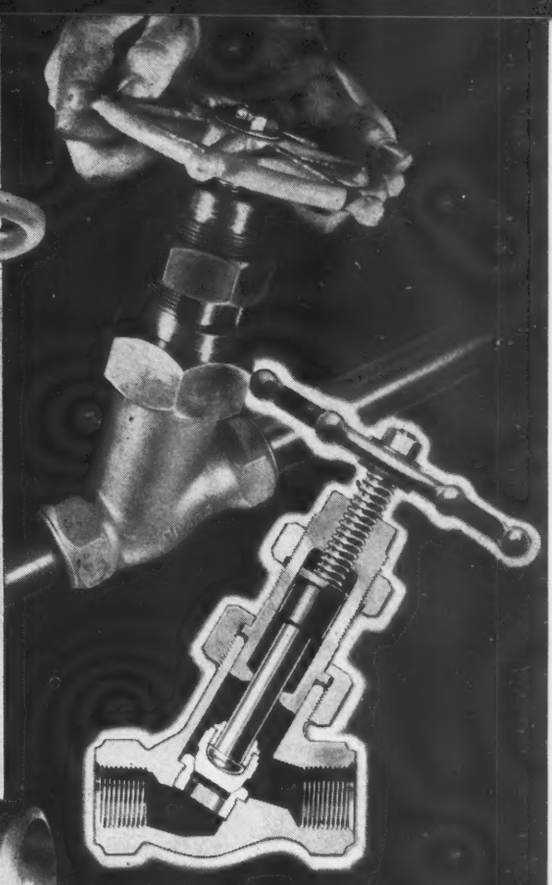
Refrigeration

Is the answer to your needs for dependable cooling service. Write

FRICK & CO.



Forged or cast steel for all operating pressures from 150 lb upward. Edward stop valves set new standards for long life, easy operation in tough service.



Edward's famous Fig. 2688 illustrates full area body, streamlined flow passages and rugged construction of entire Edward forged steel stop valve line.

Cut Your Inventories By Standardizing On EDWARD STOP VALVES

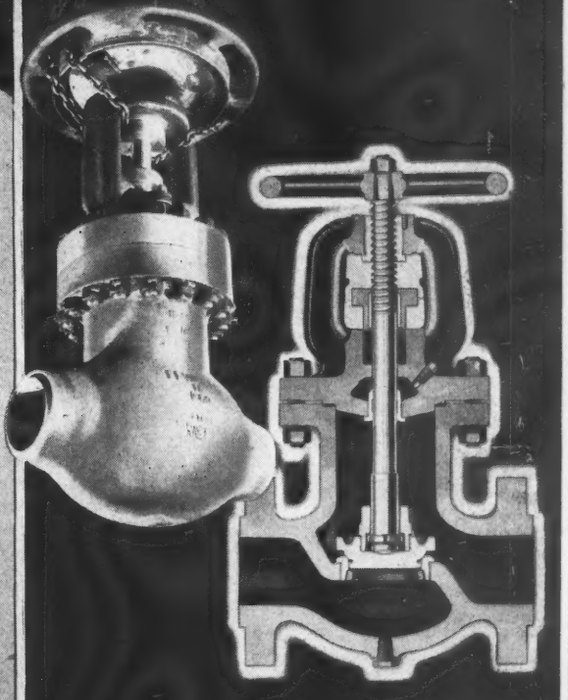
DESIGNED for maximum job and part interchangeability, Edward STOP valves make it possible to greatly reduce your inventories of spare valves and parts.

Cast or forged steel, globe or angle, ¼ in. to 16 in., 150 lb to 1500 lb and up operating pressures—the entire Edward stop valve line has many features in common. Such important things as streamlined flow for low pressure drop, sure closing action, fully guided disks, and laboratory tested materials for long service on the toughest jobs.

But important as all these are, don't undervalue the advantages of Edward interchangeability. Particularly these days when your storeroom shelves carry fewer and fewer parts.

Write for Edward BETTER VALVES Catalog No. 101.

THE EDWARD VALVE & MANUFACTURING CO., INC.
1220 W. 144th STREET · EAST CHICAGO, INDIANA

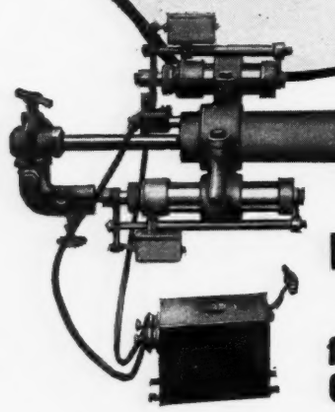


Integral, cored-out guide ribs for accurate disk guidance, patented Impactor handwheels feature Edward flanged or welding end cast steel stop valves.

EDWARD *Steel* CAST AND FORGED VALVES

a new way

TO LIGHT OFF BURNERS THAT'S FASTER-SAFER-MORE POSITIVE



ENCO AUTOMATIC RETRACTABLE OIL-ELECTRIC IGNITION SYSTEM

for lighting off PULVERIZED COAL-OIL-GAS BURNERS WITH REMOTE CONTROL

LOSS of ignition for even a short time in a large steam generating unit may, and frequently does have serious results. Turbine operation may be affected, production halted, and process work ruined.

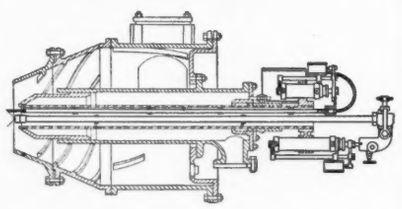
With the Enco Ignition System, the operator can light off any burner by movement of a Hand Control Valve, located close to the pulverized coal mill and fan controls, and within view of the instrument board. Automatically, a powerful ignition spark is established, and the light fuel turned on. Both are interlocked electrically—the oil valve cannot be opened until the spark current is on and the atomizer is in firing position. After the oil flame is established, a second movement of the control valve retracts the electrodes, leaving the atomizer in operation.

After ignition of the pulverized coal is established, a third movement of the control valve shuts off the oil and retracts the atomizer out of the hot zone leaving the unit ready to repeat the operation as may be needed.

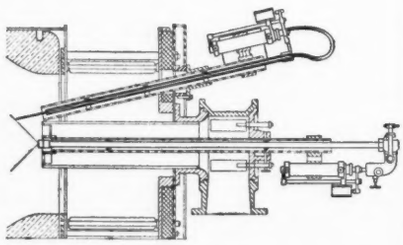
The Enco Ignition System has a wide range of application. Pulverized coal, blast furnace gas or any liquid fuel may be ignited by the unit or the spark alone may be used to ignite natural or refinery gas. The ignition flame can be gradually changed from light to heavy fuel oil if continued operation under heavy load is required. The ignition flame can also be used as a substitute for principal fuel in emergencies.

Send for illustrated booklet describing the equipment, its operation, and how it can be installed in your burners.

THE ENGINEER COMPANY
75 West Street • New York, N. Y.



Application where atomizer and electrodes are inserted in the central tube.



Application where atomizer and electrodes are inserted in separate tubes.

Enco OIL BURNING EQUIPMENT

horsepower of motors. "For this reason, in the distribution system lies our greatest opportunity to save copper through careful motor selection and, of course, through good system design," he said.

"In any electrical installation, only a small portion of copper used is contained in motor windings. The bulk is in the distribution system—in the cables, buses, etc. Let us take, for instance, an average industrial plant typical of many now being built for war production. Let's assume that 13,200-volt power is brought to this plant and then stepped down to motor voltage, and that the total installed motor capacity is 10,000 hp mostly in squirrel-cage motors. The plant is designed for 4000-kva capacity or 40% load factor."

"Now," he continued, "an average 7.5- to 10-hp squirrel-cage motor requires not more than 2 to 3 lb of copper per hp. Under the most ideal conditions, 440-volt motors powered from a materials-saving load-center system where power is stepped down near the utilization area, up to 5 lb of copper will probably be needed for each installed horsepower. If motors are selected 15 to 25% too large then in addition to needless use of materials and facilities in motor manufacture, the amount of excess distribution copper is apt to be 7500 to 12,500 lb."

Mr Umansky pointed out that the excess copper used would be much more if the old-fashioned distribution system of carrying the power through the plant at low voltage were used.

"Worse yet," he stated, "if 220-volt motors are chosen instead of 440-volt, this has no effect on the amount of copper used in the motors, but distribution copper will go up to 10 lb per hp with the load-center distribution system and up to 18 to 20 lb with the old-fashioned system. The reason for this, of course, is that much more copper is needed to carry the lower-voltage power to the motor." This is indicated on the chart which shows, A, amount of copper used in motors and distribution system of a typical war plant using 440-volt motors of correct size and a modern load-center distribution system; and, B, copper that would be used in the same plant if 220-volt motors, 25% too large were used along with an old-fashioned system bringing power at low voltage to where it is utilized.

"A further evil of 'overmotoring' that cannot be overlooked or disregarded is its effect on power factor, another avoidable waste. Many splendid plants are probably operating at low power factor today, primarily because of heavy 'overmotoring'."

STRETCH
YOUR PLANT'S STEAM CAPACITY

Are you racking your brain to figure safe ways of stretching the steam capacity of your present power plant equipment? There's a simple answer—safe, practical, effective: Hays Centralized Automatic Combustion Control, *"The All-Electric Way."*

These obvious benefits begin immediately when you install Hays Combustion Control:

- Automatic regulation of all combustion elements.
- Automatic measure of each variable—and instant automatic correction.
- Automatic *measure of each correction,* to maintain exact balance.
- Saves man hours—releases man power for other duties.
- Vital operating economies.

Hays Combustion Control is doing an outstanding job of increasing industry's steam capacity when that added capacity is most imperatively needed.

Hays Systems are individually designed to fit individual needs. Hays Combustion Control Catalog is full of useful data. Write for it.

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HAYS *Automatic* COMBUSTION CONTROL

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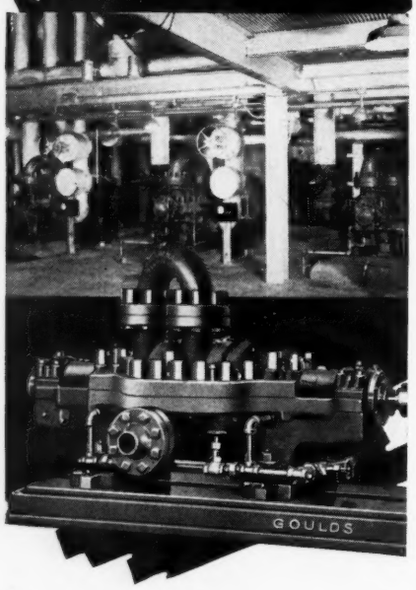
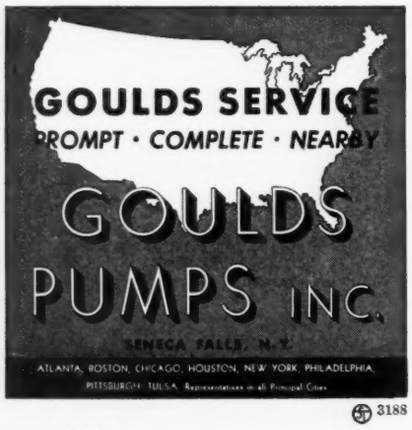
GOULDS PUMPS AT G. E. PITTSFIELD PLANT



AT the General Electric plant, Pittsfield, Mass., is another outstanding installation in which Goulds Pumps complete a picture of modern design and efficient layout. In this installation (see photo) are three Goulds Fig. 3360, 4", 6-stage Centrifugals, each rated for 550 GPM, 220° F. feedwater against 805 lbs. pressure at 3550 RPM. Two are direct-connected to 350 HP General Electric motors; the other is driven by a 350 HP General Electric steam turbine.

Lucky indeed are those who installed new Goulds Pumps before the war, for Goulds traditional dependability is insurance of trouble-free performance for many years to come. Right now, however, there is a Goulds branch office, agent or distributor near you—ready to furnish prompt assistance in getting maximum performance from whatever pumps you have.



3188

All concerned can be of great help to the war effort by adherence to the following principles, Mr Umansky felt:

1. Select motors closer to their actual duty, avoid piling up "safety margins."
2. If in doubt, do not arbitrarily select the next larger rating; perhaps the next smaller rating will do the job satisfactorily.
3. Utilize, wherever possible, the available service factor. For instance, the motor will not be injured if the service factor of 1.15 is used in some cases on the 40 C motors, although continuous operation at the resulting 50 C rise may mean that the insulation will last only 10 years rather than 20. Even more loading, up to 125% can be utilized when ambient temperatures less than 40 C are expected. Of course, always check other factors such as starting or maximum torque, etc. Sometimes these, rather than the continuous rating, determine the motor size.
4. Don't use integral horsepower motors designed for less than 440 volts, unless unavoidable.
5. Bring high-voltage power to the load centers.

Carrier Corp. Two-starred award presented recently.

Combustion Engineering Co. Award presented Oct 27.

Wickwire Spencer Steel Co. Maritime "M" Award presented at Palmer plant Oct 14.

Armstrong Cork Co. Award presented Floor Div and Closure plants Nov 30.

Conserve Tin Stocks By Electrolytic Plating

"The desperate necessity of conserving our dwindling stocks of tin caused by the shutoff of 80% of the world's tin supply from the far east has resulted in great dependence being placed on the comparatively new electrolytic tinplating industry. The expansion of this industry is now being rushed to

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24 pages of "know-how" de-scaling data!

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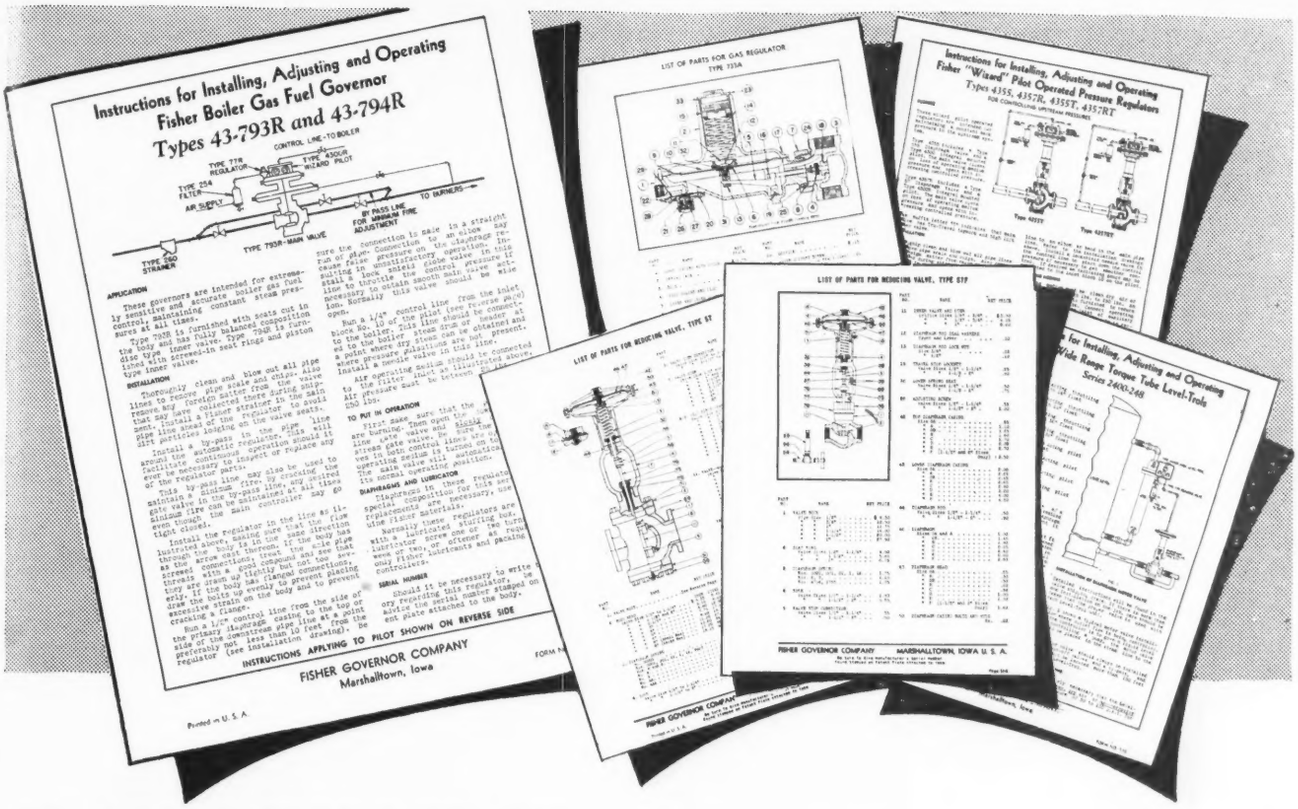
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Fisher Boiler Gas Fuel Governor
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LIST OF PARTS FOR GAS REGULATOR
TYPE 735A
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Simply give us the Serial Number that appears on each Controller. This number enables us to determine from our permanent requisition file the exact construction and operation details of your Fisher Controllers. From that information we will prepare YOUR SPECIAL MAINTENANCE MANUAL containing replacement parts specifications, as well as installation, adjustment and operation instructions.

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Proper priority certification required on all parts orders.

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423 FISHER BUILDING • MARSHALLTOWN, IOWA

take care of a large portion of the United Nations' tinplate needs."

So said J H Hopper, of General Electric's industrial engineering department, in a paper presented before the annual convention of the Association of Iron and Steel Engineers at Pittsburgh.

The use of electrolytic tinning as contrasted with the old method of hot dipping saves 60% of the tin, it was pointed out, since it makes possible a thinner and more even application of tin to the base metal.

"Most of the hot-dipped tinplate—considered by some more suitable for certain requirements — is now being used by the armed forces," Mr Hopper said. "This means that electrolytic tinplate lines now being set up will have to produce a large percentage of the plate needed for tin cans for civilian requirements. Estimates of our 1943 requirements call for 1,400,000 tons of tinplate to be electrolytically coated.

"The vision and courage of some men in the steel industry and others indirectly connected with this industry who pioneered the development of electrolytic tinplate processes many years before Pearl Harbor, has helped greatly in bringing the infant electrolytic tinning industry into maturity almost overnight."

"A year ago," the G-E engineer explained, "there were only two continuous tinplating lines capable of handling strip 30 in. wide at speeds above 300 feet per minute. By the end of the year 14 new lines will be in operation; by the middle of 1943 there will be 26 —most of them designed to handle 36-in. strips at speeds above 600 fpm.

In electrolytic tinplating, essentially a continuous process, the modern line takes finished steel strip in coil form from the rolling processes, cleans it, and then deposits a thin coating of tin electrically. Then the strip is recoiled or sheared at the end of the line.

General Electric is now rushing to completion electric equipment of various kinds for many of these tinplating lines. Described at the convention were new large-size heavy-duty copper-oxide rectifier units pioneered by General Electric, thirty-six of which are now under way at GE for three new 60,000-ampere electrolytic tinplating lines.

The rectifiers are to be used in place of large motor-generator sets conventionally used to supply the low-voltage direct-current needed for the process. "The rectifiers are just as efficient, take less space, and since they have practically no rotating equipment, re-

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. . . because Palmetto lasts longer. Each individual strand is impregnated, while hot, with a special graphite lubricant *before* braiding. The result . . . Palmetto has an *internal* reservoir of lubricant to replace the surface lubricant lost through wear. That's why Palmetto stays soft longer . . . saves shafts . . . reduces repacking time loss . . . assures smallest yearly packing cost.

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For valve stems; each strand a perfect piece of lubricated packing.

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WHEN you consider the cost of low pressure air at about 1 H.P. per 100 C.F.M., you will quickly realize the economy of Rockwell Blast Gates—the kind that are air-tight, non-chattering and provide better control of your air lines.

Light, strong, carefully machined to close air-tight, Rockwell Blast Gates are available in all types. They can be made up in aluminum, monel, bronze or other alloy metals to meet your requirements.

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BOILER FEED
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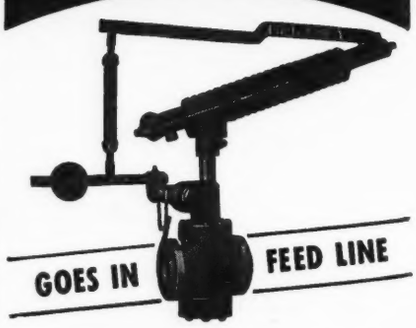

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It is work that gets raw materials from the ground, work that builds furnaces and machines, work that produces and fabricates steel, work that will win the war.

Nature has given America abundant mineral resources and tremendous manpower. Free enterprise has developed in us initiative and inventiveness and accomplishment. Now we must set these mighty forces to work with purposeful direction and willing cooperation.

When the dictators command, their millions respond immediately, unquestioningly, unreservedly. In America, it is up to every citizen to be his own dictator, to command himself to WORK immediately, unquestioningly, unreservedly.

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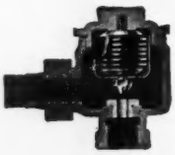
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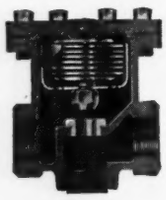
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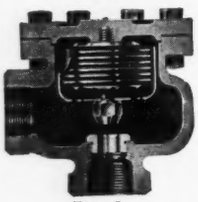
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Nicholson Steam Traps drain completely. Open wide and close tightly. Open within a few degrees temperature differential between steam and condensate. Discharge air as efficiently as water. No adjustments for changes in pressures up to maximum allowance. Large capacity. Sizes 1/4" to 2". Bronze, Cast Iron and Cast Steel constructions. Made with precision by skilled mechanics. (Bulletin No. 242)

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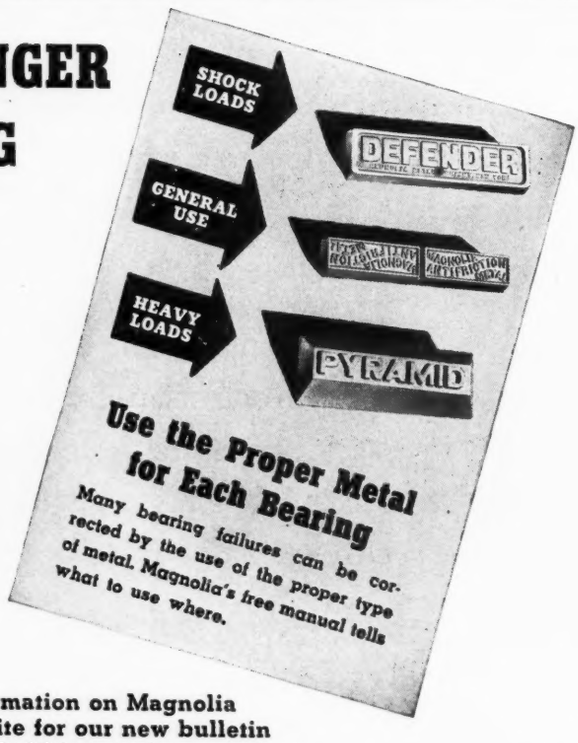
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MAGNOLIA BEARING METALS

quire much less maintenance time," said Mr Hopper.

"The large copper-oxide rectifiers now being built operate on the same principle as smaller units previously available in this country, but are designed for the high currents and heavy duty of steel mills. Standard units are 8 ft tall, 7 ft wide, and 6 ft deep, and include the necessary dry-type rectifiers, transformers, and ventilation equipment."

Another development described in connection with the new tin-plating lines is the application of an amplidyne current regulator to help hold the tin-plating current accurately proportional to the strip speed. This is accomplished while the strip is being run through at normal speed as well as when it is being run at reduced speed for welding on a new coil or for stripping the reel.

A variation of the photoelectric-amplidyne side register control, developed by GE to keep paper in register, has also been put to work on tinplating lines to assure the winding of tinplate coils with the ends square.

This equipment is based on a "floating reel" principle whereby a photoelectric scanning device mounted on the reel structure is focused on the edge of the strip as the strip passes over a dark-colored roll. Whenever the strip beneath the lens of the scanning head becomes $\frac{1}{32}$ of an inch or more off center an electrical impulse is initiated. The reel is then shifted instantaneously to the correct position to keep the coil square.

Mixing Oil and Coal For Industrial Burners

Mixing of oil and coal to produce a liquid fuel suitable for use in many industrial oil-burning furnaces has been suggested by the Bureau of Mines as one possible means of alleviating the current fuel oil shortage in the Eastern Seaboard States.

Dr R R Sayers, director, informed Secretary of the Interior Harold L Ickes that the Bureau, in cooperation with oil and coal companies, has for several months been studying the use of this type of fuel and "it appears that the problems can be solved."

On the basis of a preliminary investigation, the Bureau believes that many industrial furnaces could utilize this oil-coal fuel without material alterations in boilers and burners, Dr Sayers said and estimated that certain types of furnaces probably would save 30 to 35% of the oil ordinarily consumed.

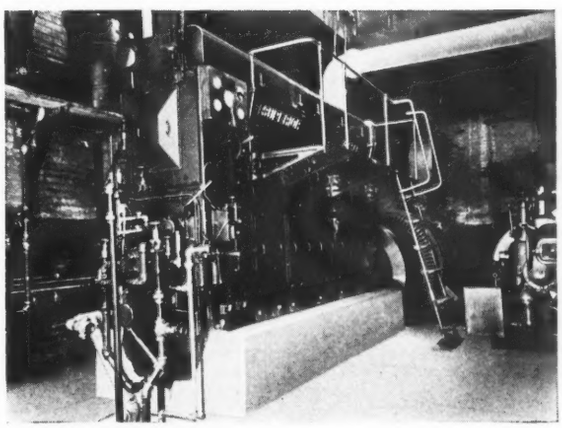
Factory Building of the Stow-Davis Furniture Company, Grand Rapids, Michigan

IN LESS THAN 3 YEARS

...The Superior Diesel Generator Set installed in the power plant of the Stow-Davis Furniture Company of Grand Rapids, Mich., HAS PAID FOR ITSELF BY SAVINGS IN POWER COSTS. Total operating expense averages less than one cent per K.W.H.; 11.2 K.W.H. are generated per gallon of fuel oil; repair costs have totalled $34.85 since the engine was installed.

Here is another example, added to many others, of Superior's outstanding ability to transform the engine room from an expensive liability to a dividend-paying asset.

For low-cost dependable power INVESTIGATE SUPERIOR DIESELS



The 315 H. P. 12½" x 15", Superior Diesel which paid for itself in less than three years

SUPERIOR ENGINE DIVISION...THE NATIONAL SUPPLY COMPANY

SALES OFFICES: Springfield, Ohio; Philadelphia, Penna.; New York, N. Y.; Los Angeles, Calif.; Jacksonville, Fla.; Houston, Texas; Chicago, Ill.; Fort Worth, Texas; Tulsa, Okla.; Boston, Mass. FACTORY: Springfield, Ohio

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Easier Maintenance with ERNST FITTINGS

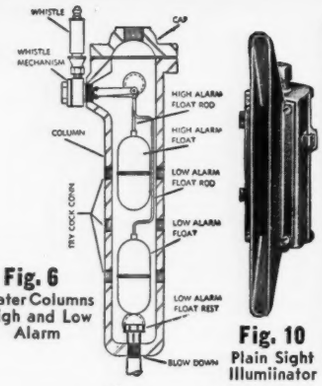

Fig. 6 Water Columns High and Low Alarm

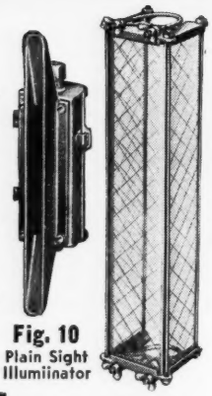

Fig. 10 Plain Sight Illumiinator

Fig. 72-3 Inclined Split-Gland Adjustable Water Gages, No Gage Glass Packing Nuts

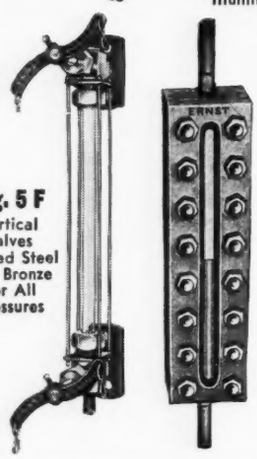

Fig. 5 F Vertical Valves Forged Steel and Bronze for All Pressures

Fig. 9 Wire Glass Better-C Guards, All Sizes

Fig. 13 Leakless Cocks, Bronze and Forged Steel

Fig 45 "C-Clear Thru" Flat Glass Inserts

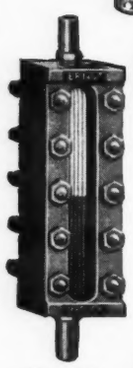

Fig. 37 C-BLACK Prismatic Flat Glass Inserts

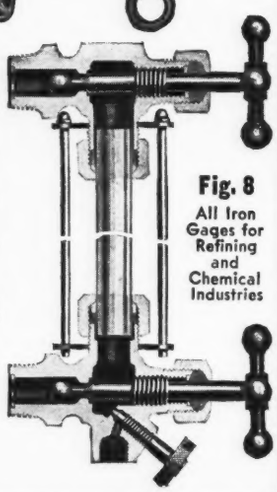

Fig. 8 All Iron Gages for Refining and Chemical Industries

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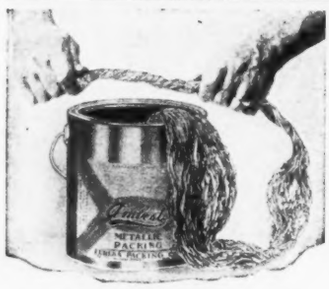

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This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

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The bureau recommends, Dr Sayers said, that a survey be made of all oil-burning plants on the East coast and that an intensive investigation be conducted into the preparation and burning of this composite fuel.

However, the success of the plan, Dr Sayers pointed out, depends on certain undetermined factors, one of which is to obtain the necessary pulverizing machinery to grind the coal before it can be mixed with the oil.

The first public announcement of the Bureau's current work in this field was made at St. Louis, Mo., on October 1, 1942, at a fuels conference held in conjunction with a regional meeting of the American Institute of Mining and Metallurgical Engineers, Dr Sayers said. Dr W C Schroeder, assistant chief of the Bureau's Fuels and Explosives Service and who is in charge of the oil-coal fuel technologic studies, presented a paper on the "Use of Mixtures of Oil and Coal in Boiler Furnaces."

At the present time, the Bureau considers as the most feasible plan one which contemplates the mixing of pulverized coal and oil in a central plant, from which the composite fuel would be delivered to industrial consumers just as fuel oil is now delivered. The consumers could use the fuel without altering their oil burners or furnaces, the Bureau believes, and this feature makes the plan particularly attractive, since no copper, steel or other vital materials would be needed to convert existing equipment. If an oil shortage forced these plants to install stokers or pulverized coal in all their furnaces, it would create a heavy demand for steel and other metals, it was shown.

"Furnaces designed exclusively for oil may have relatively small combustion space, small gas passages, and no means for removing ash from the furnace," according to the paper presented by Dr Schroeder. "Here the mixing of coal with oil must be done with care, for the combustion of the oil may be completed in the furnace while unburned coal particles reach the boiler tubes. The small gas passages may be plugged by coal and ash, particularly if the ash has a low fusion temperature."

In preparing a composite fuel, the Bureau recommends using a bituminous coal which has low ash with a high fusion temperature. Grinding as fine as possible will help to secure rapid combustion, and the use of a tar to keep the coal particles suspended in the oil "may be helpful." It may also be necessary to provide some means (probably by hand) for periodically remov-

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In times like these, when mechanical equipment of all kinds is being called upon to stand up and deliver under severest operating conditions, reports of outstanding performance carry unusual significance.

That valve users do not hesitate to acclaim Fairbanks Valves for dependability under present day conditions is evidence that maximum service with minimum maintenance is being realized. The high quality of Fairbanks Valves which assures dependability is being demonstrated and confirmed by experience in countless busy plants. Such performance leads to the simple conclusion that it's good plant practice to "Bank on Fairbanks."

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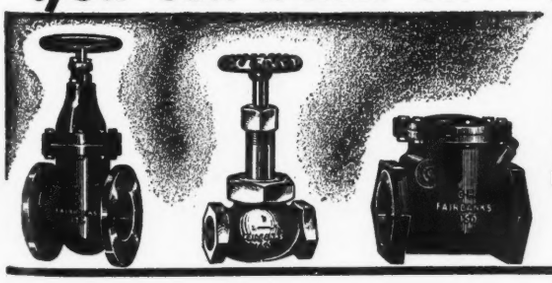

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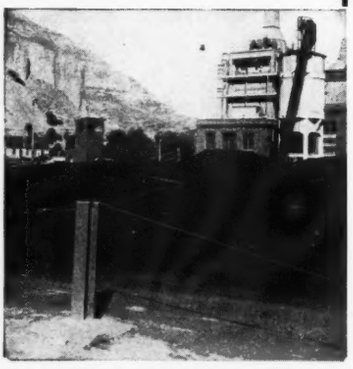

SAUERMAN Scrapers are on record as handling coal for under 2c per ton at large power plants and for only slightly more at small plants.

This operating economy is just one of many reasons why SAUERMAN Scrapers have become the most widely used equipment for open storage of coal. Other advantages are:

- Machine is simple and easy to operate. From a station overlooking the storage area the operator controls every move of the scraper through a set of automatic controls.
- Machine is adaptable to any ground space regardless of the shape or condition of the area.
- Scraper piles coal in compact layers. There is no segregation of lumps and fines; no air pockets to promote spontaneous combustion.
- Each SAUERMAN installation is a permanent, trouble-free investment. Upkeep is easy.

Picture shows coal storage yard at a 25,000 KW. central station where a 1 cu. yd. Sauerman Scraper stores and reclaims about 130,000 tons of coal per year. These scrapers are made in sizes to carry from ¼-ton to 10-ton loads of coal.

If you have any coal storage problem write for the SAUERMAN Catalog.

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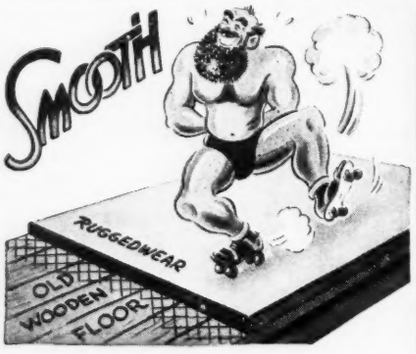
562 S. Clinton Street, Chicago

SAUERMAN

POWER SCRAPERS FOR STOCKPILING



TOUGH OVERLAY for WOOD or CONCRETE FLOORS

Add years of useful service and improve the efficiency of rough, splintered wood floors or rutted concrete floors with an overlay of durable RUGGEDWEAR RESURFACER. Your new, heavy-duty floor will have a smooth, tough, fire-resistant surface. Its resilience will withstand enormous shock . . . the stress and strain of any vibration. RUGGEDWEAR may also be used for patching holes, cracks and ruts in concrete floors to a solid feather edge. Easily applied . . . you mix the material and trowel it on. Dries fast.

Request Valuable Descriptive Folder on Tough Floors.

MAKE THIS TEST!

FLEXROCK Co.
2377 Manning St., Philadelphia, Pa.

Please send me complete RUGGEDWEAR information . . . details of FREE TRIAL OFFER—no obligation.

Name .....
Company .....
Address .....

One Formula for All These Uses

X-Pando Pipe Joint Compound is the *standard* compound in American industrial, chemical and refrigerating plants because it's more economical, more efficient, more versatile. You can't pick up the wrong can when you use X-Pando because the *one* formula holds anything carried in metal pipe. Here are a few X-Pando uses.

Ammonia Lines	Pumps
Diesel Engines	Purifiers
Oil Burners	CO_2 Lines
Freon Lines	Gasoline Lines
Refrigerant Lines	Condensers
Fuel Lines	Steam Lines
All Cargo Lines	Hot Water and all other lines

X-PANDO PIPE JOINT COMPOUND

Expands as it sets — ends leaks permanently. Corrects imperfections in threads. Smooths flanged faces. Expands and contracts with pipe movement. Not affected by vibration, high temperature, deflection, or pressure.

DISTRIBUTORS EVERYWHERE

Get X-PANDO from your local Mill Supply House.

X-PANDO CORPORATION
43-15-36th Street, Long Island City, N. Y.
Stillwell 4-7180

Canadian Distributors: La Salle Products Ltd., 159 Jean Talon St., Montreal, Quebec, Canada

ing the ash from the bottom of the furnace. Finally, the Bureau states that it may be impossible to operate a boiler at the same high rating as that attained with oil, as this will depend upon the combustion space, the size of the gas passages, the amount of ash in the coal, and the fusion temperature of the ash.

In recommending a survey of oil-burning plants on the Eastern coast, the Bureau believes that this should be conducted to determine the following facts:

(1) If they already have the necessary equipment to burn coal.

(2) If coal-burning equipment could be installed without rebuilding the furnace and boiler.

(3) If an oil-coal fuel could be used without seriously reducing the boiler rating.

(4) If the boiler would be plugged by the ash from oil-coal mixtures.

In the first case, the plants must burn coal if they have not already begun to do so; in the second, oil-coal fuel might be used until coal-burning equipment could be procured; in the third, the composite fuel would help to conserve oil without interfering with operation; while in the fourth, the boiler furnace would have to continue on oil or be shut down.

In discussing the preparation of oil-coal fuels, the Bureau points out that the problem must be approached from three viewpoints, namely, to make a mixture stable enough that no settling will occur, to provide stirrers in storage and transportation equipment, or to mix the oil and coal at a plant where they are to be used. The last procedure would make it necessary to pulverize coal at the plant or to ship it to the plant, requiring careful handling to minimize the hazards from accidental inflammation of suspensions of coal dust in air.

The Bureau of Mines and the Office of the Petroleum Coordinator are continuing to work with oil and coal companies to develop the use of this fuel. Dr Sayers stated, in an effort to attain widespread commercial application and marketing of the fuel as a means of assisting the Nation at war.

Steel Belt

Already speeding the flow of iron ore to the nation's blast furnaces, a new type of conveyor belt which uses steel cables in place of the customary cords or fabric was announced today by the Goodyear Tire & Rubber Company. One of the steel-carcass conveyor belts

SEGREGATED *Scrap...*

is your link to VICTORY!

Scrap salvage is a vital factor in the war effort. To be fully effective a scrap program must include methods for segregating and conserving critical alloying elements so urgently needed in the construction of tanks, guns, ships and planes.

Ferrous and non-ferrous metal scrap should be collected in separate containers at the machine where they are generated. Each class of high-speed tool steel and each type of constructional alloy steel should likewise be kept separate so that the alloy content can be returned to service.

Remember, — alloy scrap which is segregated, classified and labeled according to type and composition is a vitally important commodity today—and urgently needed to augment primary supplies of Nickel, molybdenum, tungsten, etc.

The metallurgical experience of our technical staff is available to aid you in these and other phases of metal salvage.

KEEP SCRAP MOVING INTO WAR PRODUCTION!

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

DAVIS offers

A Service for Engineers who want "THE RIGHT VALVE FOR THE JOB!"

RIGHT now many engineers are faced with a problem. To get the kind of performance they want involves SPECIAL design and construction in the equipment going into power, process and heating jobs; but to get quickest possible delivery and reasonable costs, wisdom dictates use of STANDARD items wherever possible.

It is in such situations that DAVIS can come to your assistance with what is believed to be the broadest line of automatic valve specialties in existence today. Features which you might consider "special" are often found to be standard with DAVIS, making unnecessary a long wait for special equipment to be designed and built. *For your own protection, always make it a habit to check with Davis on any automatic valve need!*

Do you have the latest **DAVIS** *Bulletins?*

DAVIS REGULATOR CO., 2540 S. Washtenaw Ave., Chicago

Without obligating me, please MAIL literature describing:

- ☐ Pressure Regulators and Pump Governors (including service and capacity charts).
- ☐ Pressure Relief, Back Pressure and Exhaust Relief Valves.
- ☐ Liquid Level Controllers for closed tanks.
- ☐ Lever and Float Operated Valves.
- ☐ Solenoid Valves for Industrial service.
- ☐ Stop and Check, Non-Return and Balanced Check Valves.
- ☐ Strainers.
- ☐ A specific problem is outlined on the attached sheet. We would appreciate your recommendations

Name .....

Company .....

Address .....

is already in use at the Oliver Iron Mining Company, Duluth, Minn. This belt is being used at the mine to lift ore 240 feet in an 1100-foot conveyor.

By means of the belt's newly-developed carcass of steel cables, the belt completes the lifting task in one continuous operation. It obviates the one, two or three transfers from individual belts which would have been necessary with the old type of conventional cotton fabric or cotton cord construction.

Although no thicker than a conveyor belt with, for example, six plies of fabric, the new belt's strength is actually the equivalent of 14 such plies.

Before perfecting steel cables for the carcasses of conveyor belts, the Goodyear engineers experimented at length with other materials in their search for added strength without loss of flex life or adhesion to the pulleys.

Dig Deeper!

Donald M Nelson, chairman of the War Production Board, recently asked business and industrial concerns throughout the country to "dig deep and then even deeper" for vital scrap materials.

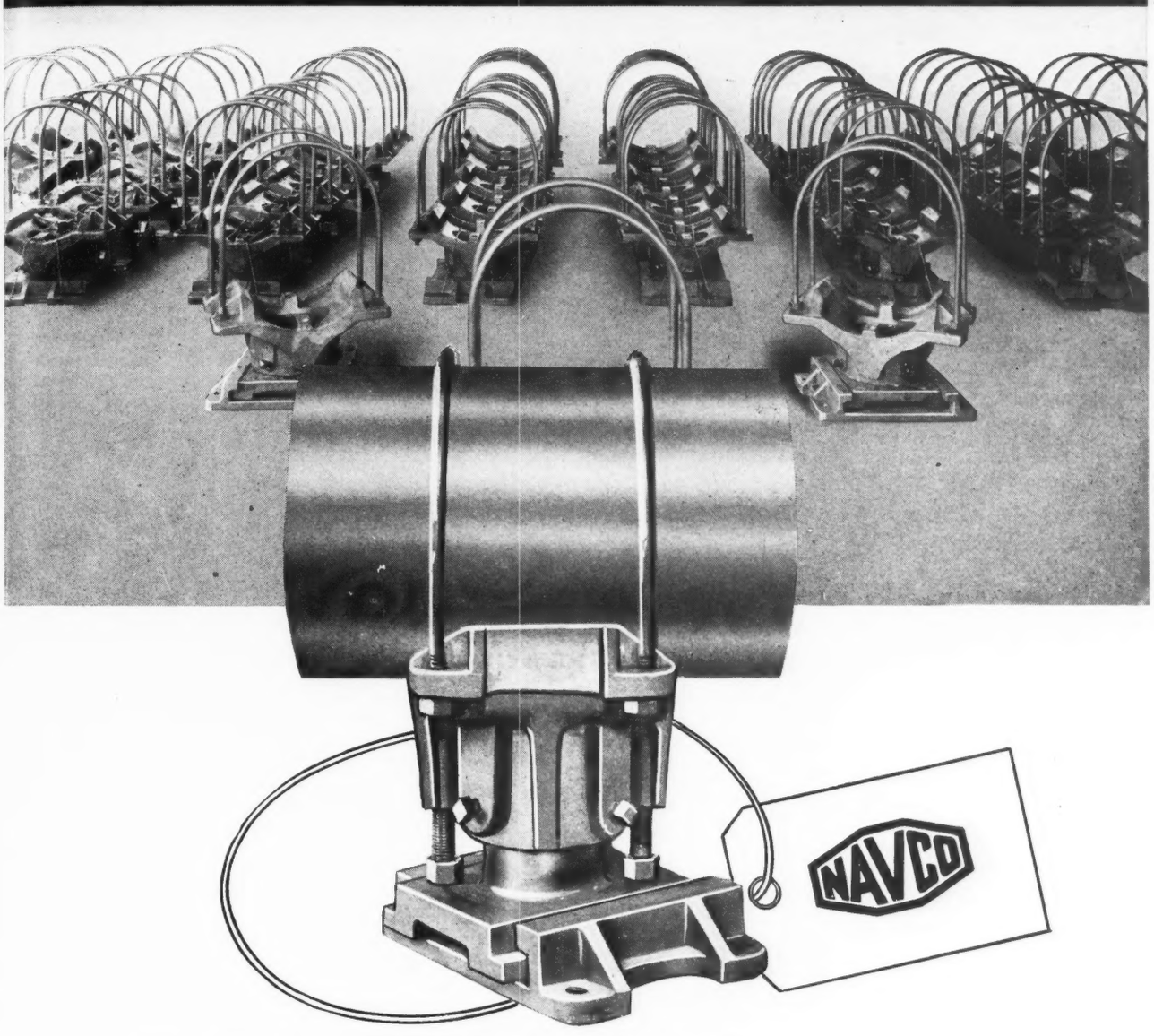
"More scrap," he said, "is expected from industrial plants than from the farms and homes of the country. Nothing is more important to war production than scrap. The amount of scrap we get depends in large measure on industrial scrap. It is essential to the successful solving of the winter supply problem.

"It is the job of every president, every purchasing agent, every salvage manager, every plant superintendent, every shop foreman and every workman to dig and then even deeper for dormant as well as production scrap. Every plant must undergo a thorough, old-fashioned house cleaning. Store-rooms and rubbish piles will reveal tons of old, worn-out equipment and stocks, broken-down machinery and discarded tools. All such scrap materials are wanted badly. Although plant executives may feel that every effort has been made to move scrap from their plant, they should search again and again to make certain that nothing is overlooked. Even if it is only a small item, that item may help save a soldier's life.

"Any equipment that can be used or that can be repaired and put to use for the war effort is not scrap. But what cannot be used belongs on the nation's scrap pile.

"During the second half of 1942 we must get at least 12 million tons of scrap from industrial firms. This is a big order. But, nonetheless, we must

NAVCO "UNIVERSAL" PIPE SUPPORTS



Navco Universal Support will take care of eight inches of expansion and can be made special to accommodate any amount of travel.

Vertical adjustment up to 2½ inches can be made.

Support may be turned to any angle of 360°.

Holds pipe down as well as up. Prevents pipe from getting out of alignment, which is usual in the Roller Type of support.

It permits control of expansion movement of pipe and insures the desired free action of Slip Expansion Joints so essential in tunnel and duct work.

Carrier is fixed to a predetermined point on the pipe, thereby eliminating possibility of destroying insulation. There is a recess in the saddle for insulation and the entire support can be insulated on the outside.

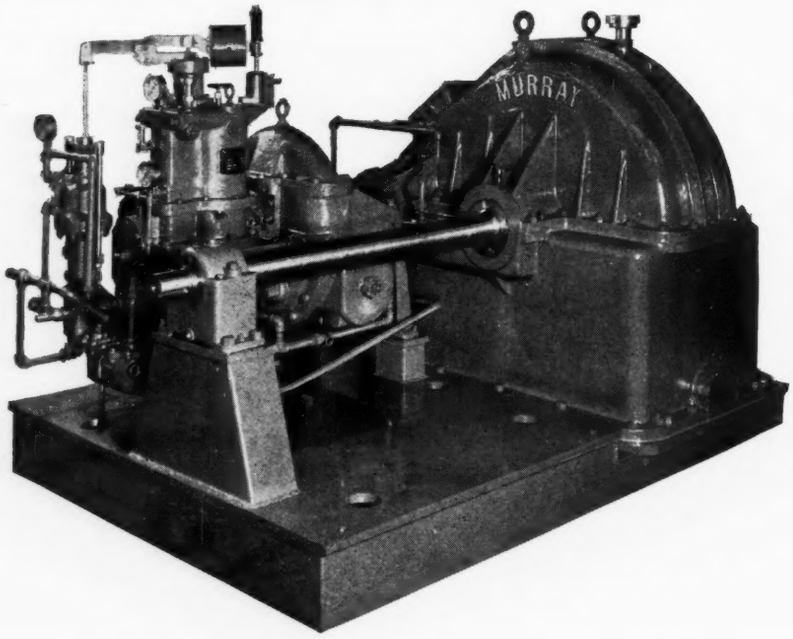
Navco Universal Pipe Supports are made of cast iron but can also be furnished in steel at increased prices. For installations exposed to the weather, bases can be furnished with brass liners or provided with forced lubrication.

NATIONAL VALVE MANUFACTURING COMPANY • PITTSBURGH, PA.

ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA

MURRAY'S *70 years of experience*

HIGHLY VALUABLE IN VICTORY PRODUCTION



MURRAY TURBINES

WITH HIGH OVERALL EFFICIENCY

giving war industries adequate and dependable power facilities

Each MURRAY Turbine shipped from this organization is consigned to a war plant. That is our production schedule for the duration. Our entire facilities are devoted to meeting high priority needs.

Even though you may not have a rating that entitles you to purchase a MURRAY Turbine now, it may pay you to investigate. Find out the advantages MURRAY design and construction offer. When the time comes that restrictions in deliveries are lifted, you will have an answer all ready for your turbine needs.

The same applies to MURRAY Boilers and Engines—write for bulletins.

BOILERS TURBINES ENGINES

MURRAY IRON WORKS COMPANY

INCORPORATED 1870

BURLINGTON IOWA

reach that goal before winter, when normal supplies of scrap fall off. The need is great; time is all important. And all plants can expect excellent cooperation from the Industrial Salvage Section of the War Production Board, from local communities and from the newspapers of the nation.

"Judging from the unprecedented results obtained by the newspapers in their recent general salvage drive, we know the kind of cooperation they can give, and we are grateful to them for their magnificent job," Mr. Nelson said.

On October 1 the field force of the Industrial Salvage Section was supplemented by 2,500 volunteer salesmen and sales executives to contact 70,000 industrial firms for the purpose of moving dormant scrap. These firms are being asked to make an inventory of all dormant scrap materials and to make a complete disposal of all these materials through regularly organized scrap dealer channels as rapidly as possible.

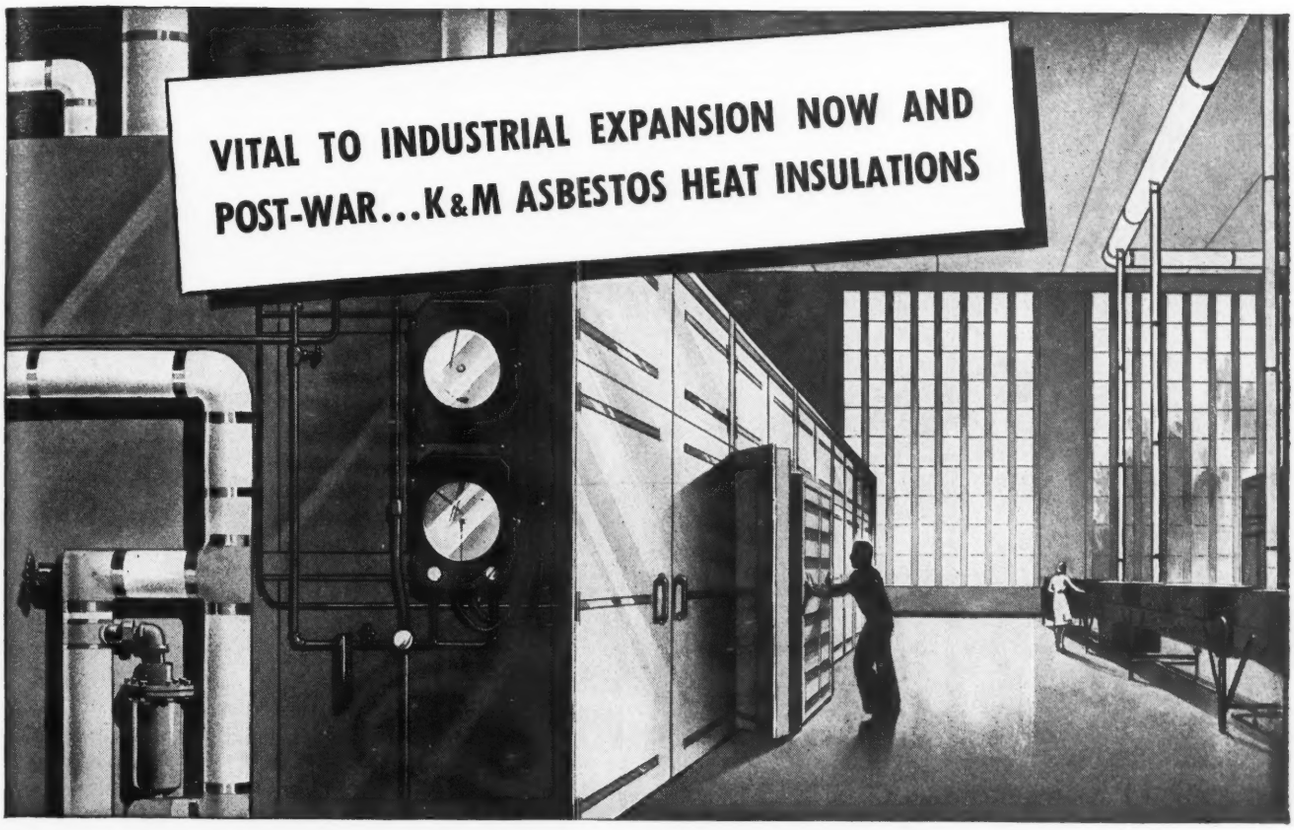
Dormant scrap is defined as obsolete machinery, tools, equipment, dies, jigs, fixtures, etc, which are incapable of current or future use in the war production effort because they are broken, worn-out, irreparable, dismantled, or in need of unavailable parts necessary to practical reemployment.

Fritz Medal Awarded to Willis Whitney

Willis Rodney Whitney, chemist, engineer, inventor, author and educator, has been announced as the recipient of the 1943 John Fritz Medal. Doctor Whitney has been awarded the medal "for distinguished research, both as an individual investigator and as an outstanding and inspiring administrator of pioneering enterprise, co-ordinating pure science with the service of society through industry."

First bestowed in 1902 to John Fritz of Bethlehem, Pa., pioneer iron-master and engineer in whose honor the award was established, the John Fritz Gold Medal is awarded annually for "notable scientific or industrial achievement, without restriction on account of nationality or sex." It is an honor conferred jointly by a board composed of four representatives of each of four national societies, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, with a collective membership totalling approximately 65,000. The Medal funds

Looking ahead with Asbestos



To feed a hungry world top efficiency will be needed; and there certainly is none in shipping abroad tremendous quantities of water naturally present in fruits, meats and vegetables. Surely the dehydration of foods will be even more vigorously practiced than at present; and the success of this practice will depend in great part on efficient insulation.

Forward-looking plants, busy now expanding their manufacturing facilities to meet the needs of this fast-growing market, will not overlook the proven insulating qualities of K&M "Featherweight" 85% Magnesia. In many war and before-the-war industries, this heat conserver has been able to cut fuel costs enough to pay for itself in a year. The complete K&M insulation line, designed for specialized service on pipes, flanges, breechings and boilers, covers a temperature range from 32° F. to 1900° F.

Naturally, because it is in heavy demand for vital war activities, K&M 85% Magnesia is available only on high priority. But with the coming of peace, it will be plentiful again, ready to do its conserving work for industry at large. Meanwhile, you may be sure, K&M research continues to explore new ways of making asbestos contribute still more to the comfort, convenience and safety of the world.

* * *

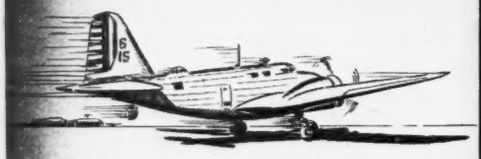
Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer, has made it serve mankind... since 1873

KEASBEY & MATTISON

COMPANY, AMBLER, PENNSYLVANIA

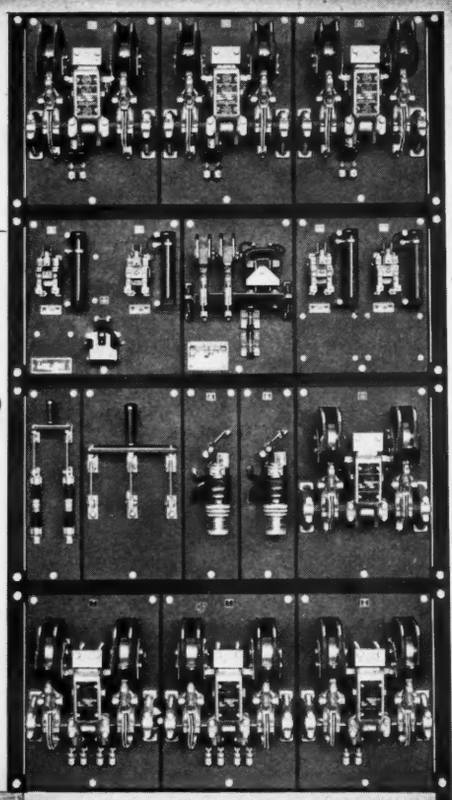
Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains



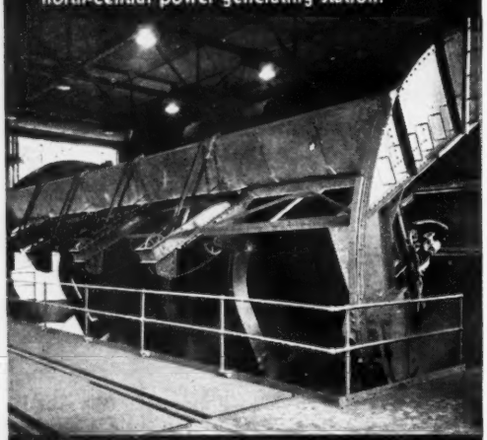
Smooth Acceleration

EC&M FREQUENCY RELAY MAGNETIC CONTROL



60 HP, 440 Volt EC&M Frequency Relay Magnetic Controller for car dumper illustrated below.

End view of Wellman Engineering Co. Rotary Car Dumper recently installed in north-central power generating station.



Car Dumper in extreme dump position. Limit Switches provide slowdown and stop at both limits of travel.

FROM standstill on the runway until the wheels leave the ground, the modern airplane increases in speed uniformly and smoothly over the entire distance required for the take-off.

Likewise, EC&M Frequency Relay Magnetic Control brings a-c wound-rotor motor-driven machines up to speed equally as smoothly and uniformly from the instant power is applied until the motor is running at full speed.

Besides being easy on the motor . . . and easy on the machinery during acceleration, this control can be designed to meet specific torque requirements for certain starting conditions such as encountered in wire drawing. In this instance, proper secondary resistance is chosen to give suitable starting and accelerating torque which will eliminate wire breakage and EC&M Frequency Relay Acceleration matches these pre-selected values to the load for smooth, safe acceleration.

Ask for Literature No. 930 on EC&M Frequency Relay Magnetic Control.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

EC&M Frequency Relay Acceleration matches motor torque to the requirements of the load.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

are administered by United Engineering Trustees, Inc, joint organization of these four societies.

Doctor Whitney was born in Jamestown, N. Y., on August 22, 1868. He was graduated from Massachusetts Institute of Technology with the degree of bachelor of science (1890), and from the University of Leipzig with the degree of doctor of philosophy (1896). He has also received the honorary degrees of doctor of science from Union College (1919), Syracuse University (1925), University of Michigan (1927), University of Rochester (1932); doctor of chemistry, University of Pittsburgh (1919); and doctor of laws, Lehigh University (1929).

Since his graduation from Massachusetts Institute of Technology he has held the following positions at that institution: assistant instructor, general chemistry (1890–92), analytical chemistry (1892–94), sanitary chemistry (1896–98); instructor, theoretical chemistry and proximate analysis (1898–01); assistant professor, theoretical chemistry (1901–04); nonresident associate professor, theoretical chemistry (1904–08); and nonresident professor of chemical research since 1908.

In 1900 when the research laboratories of General Electric Company were established at Schenectady, N. Y., Doctor Whitney was appointed director of research. He became vice-president of the company and director of research in 1928, and in 1932 vice-president in general charge of research.

Westinghouse 'Calls All Horsepower' For War

In a drive to get more war production out of electric motors and at the same time save up to 40% of the copper, steel and aluminum used in their manufacture, Westinghouse Electric and Manufacturing Company recently began a calling-all-horsepower campaign.

This is being done in cooperation with the War Production Board which has asked motor users to load each unit to the limit.

In a letter to Westinghouse engineers, salesmen, jobbers and industrial agents, A C Streamer, Westinghouse vice president, wrote,

"It may seem strange to you that we, who have always been advocates of conservatism in the application of motors and control, should now promote an upward rating, but the shortage of critical materials is daily becoming more acute, and it is, therefore, defi-

Rockbestos A.V.C.

KEEPS STEADY COMPANY

with High Temperatures

Rockbestos A.V.C. Power Cable above and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code Type AVA) has a maximum operating temperature rating of 110°C. (230°F.) and this permanently insulated construction.

1 The conductor is perfectly and permanently centered in helically applied insulation.

2 Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to an arc.

3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.

4 Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.

5 A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease or corrosive fumes.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

You can avoid repeated rewiring jobs on circuits that run around boilers, steam lines, furnaces, lehrs, soaking pits, kilns and other hot spots by using Rockbestos A.V.C., the wire that's built to keep steady company with high temperatures.

Its permanent asbestos — varnished cambric insulation — and rugged, heatproof, fireproof, moisture-resistant asbestos braid won't bake brittle under heat, won't dry out with age, won't crack under vibration and won't bloom, flow or rot from exposure to oil, grease, alkalies or corrosive fumes.

Insure your plant against production-delaying wire-failures in "hot spot" power, control and lighting circuits by using Rockbestos A.V.C. wire, cable or cord designed for severe operating conditions. Our engineers will be glad to make recommendations from a line of 122 *permanently insulated* constructions.

When inquiring or ordering give end-use classification and authorized preference rating. For information write nearest branch office or:

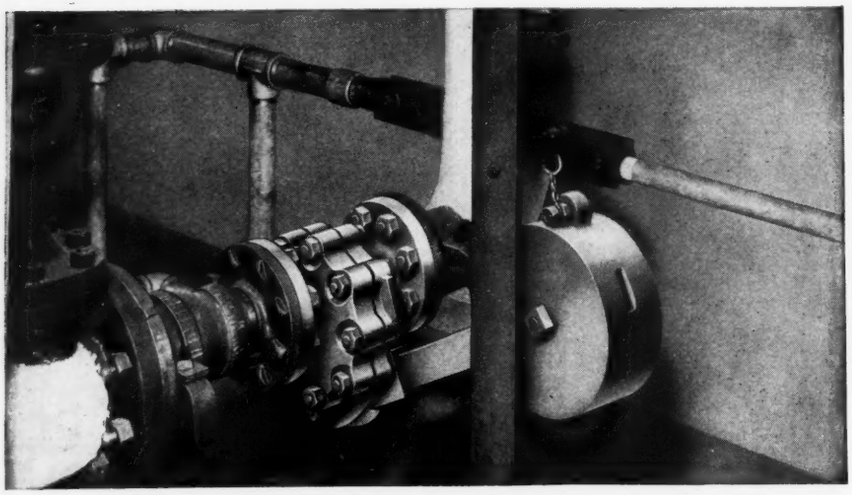
ROCKBESTOS PRODUCTS CORP., 875 NICOLL STREET, NEW HAVEN, CONN.

PERMANENTLY INSULATED ROCKBESTOS WIRES AND CABLES

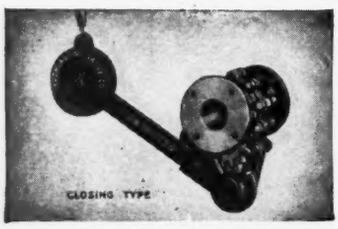
ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

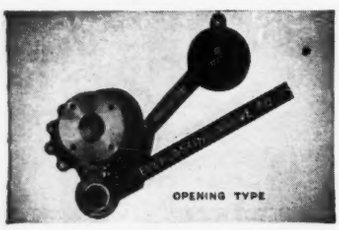


VALVES . . . *that operate instantly . . . unfailingly* FOR FIRE PROTECTION



CLOSING TYPE

For emergency shut-off of the flow of inflammable liquids or to concentrate water or steam on fire mains. Sizes 1-in. to 8-in.



OPENING TYPE

For diversion of water to sprinkler deluge or water curtain systems or to divert inflammable liquids to a point of safety. Sizes 1-in. to 8-in.

Both types may be controlled thermostatically, electrically, or manually from any or many sources.

Everlasting Valves, weight-operated with pendulum stop, are expressly suited to fire protection service. These positive-acting, thoroughly reliable valves are widely used on foam systems, sprinkler systems, fuel line shut-off, dip tank discharge, enamelling tank discharge, electric generator protection, and similar services.

FEATURES

WILL NOT STICK . . . because made of materials which will not corrode under working conditions

WILL NOT BIND . . . because there is no external stuffing box that might be improperly packed

WILL NOT WEDGE . . . because disc travels in a line parallel with both interior of upper bonnet and seat

WILL NOT CLOG . . . because straight-through design permits full, unimpeded flow

Ask for Bulletin E-52B

EVERLASTING VALVE COMPANY

49 FISK STREET **JERSEY CITY, N. J.**

Everlasting Valves

for everlasting protection

nitely up to each one of us to do our part in conservation."

To make full use of all motor horsepower, six recommendations were made:

1. Motors open to the air should be overloaded 25% above their nameplate rating unless the surrounding temperature is exceptionally high. Enclosed motors can be overloaded 10% and direct current open motors 15% under the same conditions.

2. Most plants using small motors have 200 or 440-volt power supplies. WPB has asked that 440 volts be used because this reduces the amount of copper required in leads and control apparatus.

3. Use standard sealed sleeve bearing motors unless ball bearing motors are absolutely essential. Ball bearings are urgently needed in other war machinery.

4. Use motors of highest practical standard speed and void use of multi-speed motors. Faster motors are smaller and requires less critical materials.

5. Use alternating-current motors in preference to direct-current types wherever possible. This saves substantial amounts of copper and helps alleviate a shortage of direct-current motor manufacturing capacity.

6. Match control and circuit protective equipment to the motor on the basis of nameplate horsepower rating, thus getting the maximum use from control equipment.

These examples of saving were cited:

Thirty-six pounds of vital materials are conserved by using a motor rated at one horsepower, instead of 1½ horsepower, for a 1¼ horsepower load.

Sixty-three pounds of materials are saved by using a motor rated at five horsepower for a 6¼ horsepower load. Ordinarily, a motor rated at 7½ horsepower would be applied to such a job.

Five hundred and fifty pounds of material are saved when a motor rated at 100 horsepower is used for a 125 horsepower maximum load. Usually, a 125-horsepower motor would be ordered.

The program calls for close teamwork between industry and Westinghouse engineers to determine the exact horsepower needed by each machine that is to be driven.

American Standards, 1942

The American Standards Association has announced the publication of its newest List of American Standards for 1942.

More than 550 American Standards are listed, of which 71 represent new and revised standards approved since

KEEP 'EM FLUSHING

Facts you should know on how to get greater savings of man-hours, water, fuel and power from flush valves . . .

TODAY, hundreds of thousands of flush valves are on duty in the nation's industrial plants, office buildings, hospitals, cantonments, army and navy bases, schools, apartments, hotels and many other types of buildings.

These flush valves were selected because of their ability to stand up under severe service, for their ability to save water, and for their ability to do their job day in and day out with a minimum of attention.

It is of greatest importance that these advantages be utilized to the utmost today. Valves must be kept flushing—man-hours required for maintenance must be kept at a minimum—and water savings must be increased to a maximum. Due to the fact that during the war, new flush valves probably will not be available for civilian requirements, present equipment must be carefully conserved.

To attain these objectives a complete understanding of the how and why of flush valve operation and maintenance is extremely important.

To meet the need for more information on this subject, a new 16 page manual on the maintenance of flush valves—"Keep 'Em Flushing"—has just been published by The Imperial Brass Mfg. Company. (See description below). Write for your copy.

THIS MANUAL IS VALUABLE to anyone who specifies, installs or maintains flush valves . . . *tells*—

- how a flush valve operates.
- how to get maximum water savings from flush valves.
- how to keep maintenance time at a minimum.

includes

Flush valve "trouble-shooter" chart and other practical data.

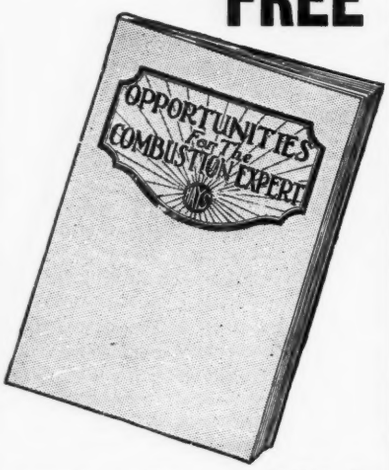
ESPECIALLY HELPFUL at Army, Navy and Air bases.

THE IMPERIAL BRASS MFG. CO.
514 South Racine Ave., Chicago, Illinois

Watrous Flush Valves

DIAPHRAGM and PISTON TYPES . . . also furnished with *SILENT-ACTION* equipment

This Book is Yours .. FREE



Combustion Efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man — the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

Just a Few of Our Hundreds of Friends

International Harvester Co.	30
Armour and Co.	75
Combustion Engineering Company	45
Riley Stoker Corp.	75
Iron Fireman Mfg. Co.	85
Commonwealth Edison Company	148
State of Illinois	85
Cities Service (Oil & Power)	70
and many others	

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the last (February 1942) issue of the list. There is a separate heading for American War Standards—standards developed specifically for the war effort.

Another section is devoted to American Safety Standards, which are also of great importance to the war effort in connection with the President's program for the conservation of manpower. Other standards include definitions of technical terms, specifications for metals and other materials, methods of test for the finished product, dimensions, etc. They reach into every important engineering field and serve as a basis for many municipal, state and Federal regulations. This particular List of Standards will serve as a useful reference piece to the engineering and purchasing departments of many manufacturing firms.

More Accredited Schools

Notre Dame and the University of Toledo have been added to the list of United States colleges whose engineering courses have been accredited by Engineers' Council for Professional Development, joint agency of eight engineering societies in the United States and Canada. At Notre Dame, curricula in aeronautical, civil, electrical, mechanical, and metallurgical engineering have been accredited; and at the Toledo school, the course in general engineering. Additional curricula have also been inspected and accredited by Council at twelve other colleges: chemical engineering at Bucknell (Lewisburg, Pa.); mechanical engineering at Catholic University of America (Washington, D. C.); chemical engineering at Cooper Union Night School of Engineering (New York City); chemical engineering at the University of Florida (Gainesville); ceramic engineering at Georgia Tech (Atlanta); geological engineering at Idaho (Moscow); chemical engineering at Maryland (College Park); chemical engineering at Northeastern (Boston); chemical engineering at Oregon State (Corvalis); aeronautical engineering at Texas A & M (College Station); civil, electrical, and mechanical engineering at Southern California (Los Angeles); and chemical engineering at Worcester Tech (Worcester, Mass.).

At the tenth annual meeting of the Council, just concluded in New York City, R E Doherty, president of Carnegie Institute of Technology, was reelected chairman. Other officers elected are S D Kirkpatrick, editor of *Chemical and Metallurgical Engineering*, vice-chairman; A B Parsons, secretary of the American Institute of Mining and

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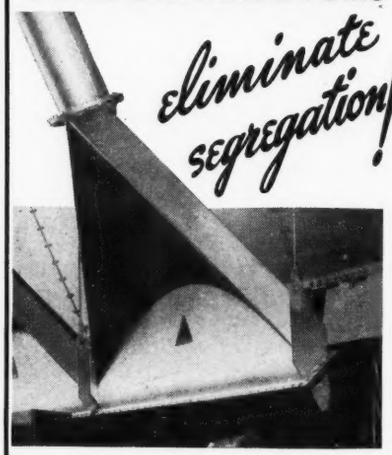

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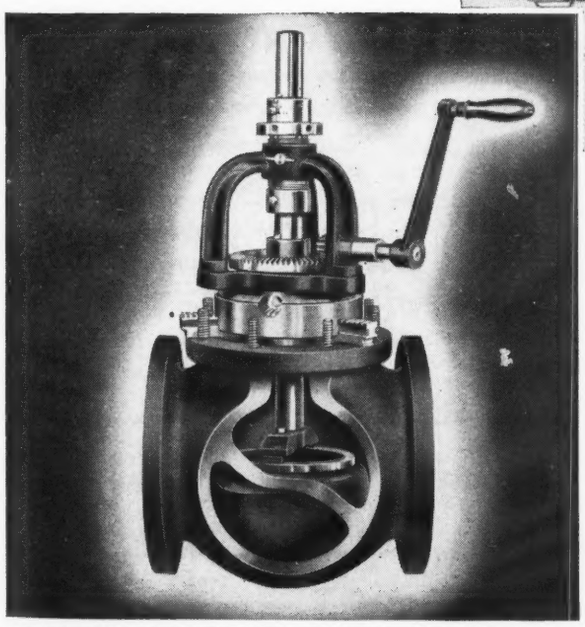

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Metallurgical Engineers, secretary; S L Tyler, executive secretary of the American Institute of Chemical Engineers, assistant secretary.

Committee chairmen, representing the Council's four fields of work, were named as follows: Committee on Student Selection and Guidance—A R Cullimore, president, Newark College of Engineering; Committee on Engineering Schools—D B Prentice, president of Rose Polytechnic Institute; Committee on Professional Training—Everett S Lee, engineer, general engineering laboratory, General Electric Company; and Committee on Professional Recognition—Charles F Scott, of New Haven, Connecticut.

What Do You Want To Know About Machine-Shops?

The other day the chief electrical engineer of a big metallurgical plant dropped into POWER's office to say his maintenance men would have to start making certain power-equipment replacement parts he had to have and couldn't buy because of shortages. He suggested that POWER tell readers how to make such items as a wartime service. The editors are willing to attempt this if there is a real demand. Let me know at once if you want this kind of information — also what particular items you must learn how to make. If the demand is sufficient we will try to publish the information the average maintenance mechanic would require to set the job up and finish it.

PHIL SWAIN, *Editor*

Joseph Porter Dies

Joseph F Porter, chairman of the board of the Kansas City Power & Light Company, died Saturday, November 7th in Kansas City, Missouri. Mr Porter had been ill for the last eight months. He passed his seventy-ninth birthday last June 27th.

He was president of the Kansas City Power & Light Company from 1917 until 1938. Although his retirement from active management of the company in 1938 freed him from the detailed responsibility for the company's operations, Mr Porter was in his office up to a few months before his last illness.

Having headed the company from a time when it was an unimportant division of the Street Railways Company, Mr Porter was known and loved by hundreds of employees who, in the

EASY TO USE MANOMETER DATA

Contained in the new Simplex Bulletin No. 200 is information for the user of manometers. It covers the complete line of Simplex manometers and accessories, and details in concise, usable form, basic data and formulae applying to the use and application of this equipment.

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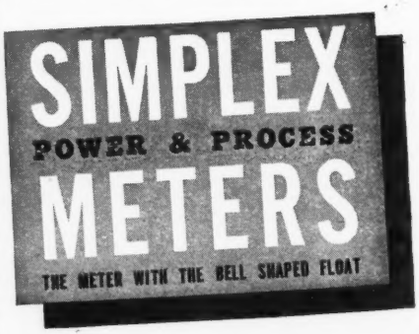

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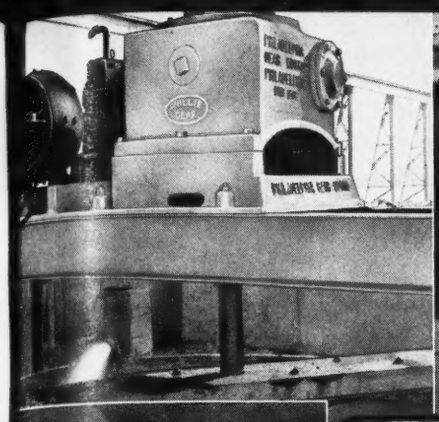

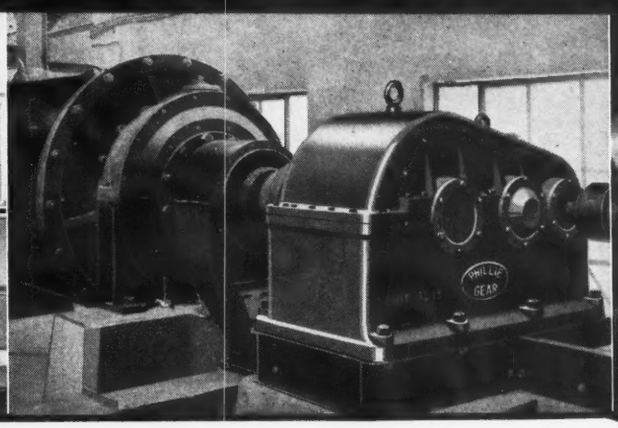

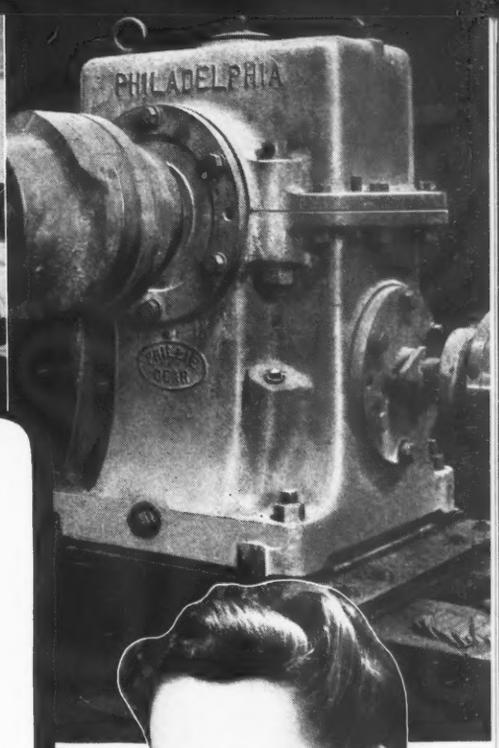

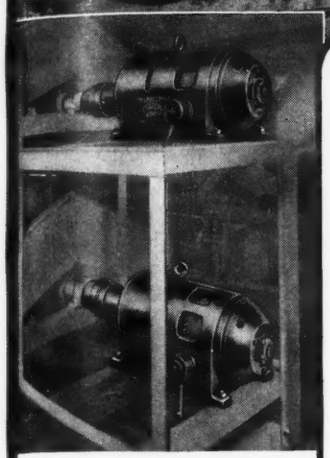

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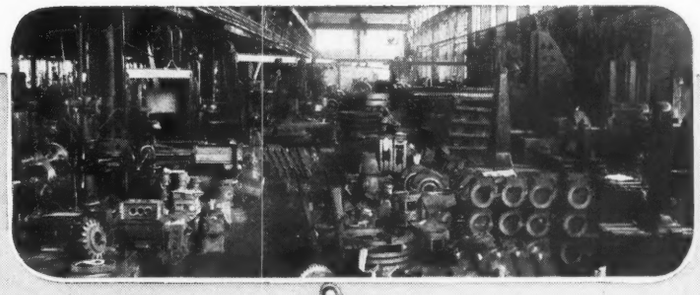

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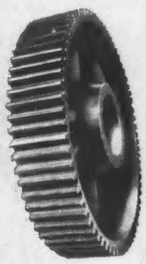

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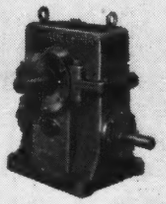

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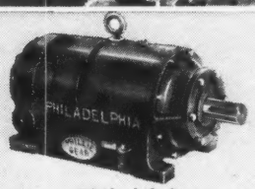

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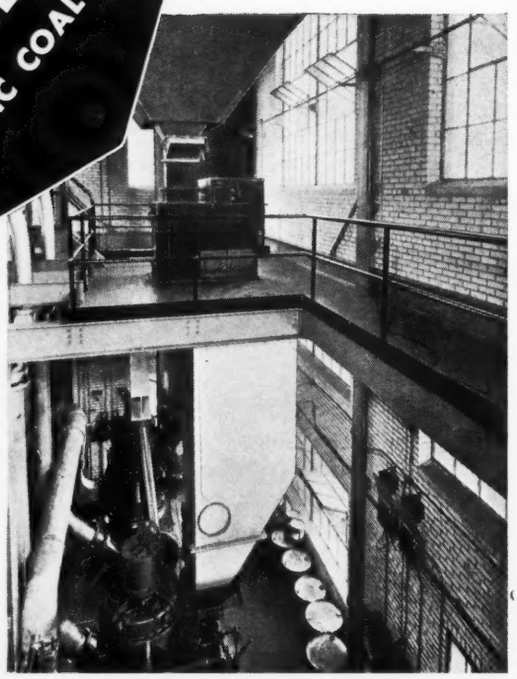

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earlier days, came in daily contact with him.

Two sons of Mr Porter are now actively engaged in the management of the company, Joseph F Porter, Jr, vice president in charge of sales; and Clyde F Porter, manager of the company's East district.

Foreign Patents Available to Industry

Drawings and specifications of all foreign-owned enemy patents seized by the Alien Property Custodian are to be printed by the Government and made available to American industry at a nominal price. Printing will begin in December, with availability of particular patents announced through the Office Gazette of the patent office.

The move is part of the Government's program to use all means to put enemy-owned property and patents to work in support of the nation's war effort.

Short-Cut Method of Determining Motor Hp

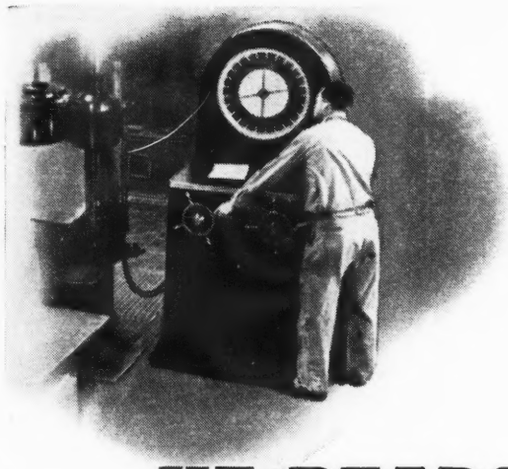
Joseph A Setter
Industrial Department
General Electric Company
Denver, Colorado

With the accelerated pace of the war production program, many machines and factories are now working around the clock. This means in many instances that some machines are being loaded with heavier production schedules than they were originally designed for, while others are underloaded. Too, the great demands for new machinery have led to the installation of much used equipment which in many cases is overmotored in relation to the immediate job.

It is a well-known fact that underloaded induction motors operate at very poor power factor and draw an excessive amount of lagging current. This in turn wastes vitally needed power in all feeders and in distribution equipment clear back to the generating station power.

Frequently these difficulties can be overcome by checking the load and, on the basis of such a check, switching motors on some of the machines to improve the load factor. The purpose of this article is to present a simple method whereby loading on integral-horsepower induction motors can be determined with practical accuracy by means of a hook-on-volt-ammeter.

This method is of unknown origin



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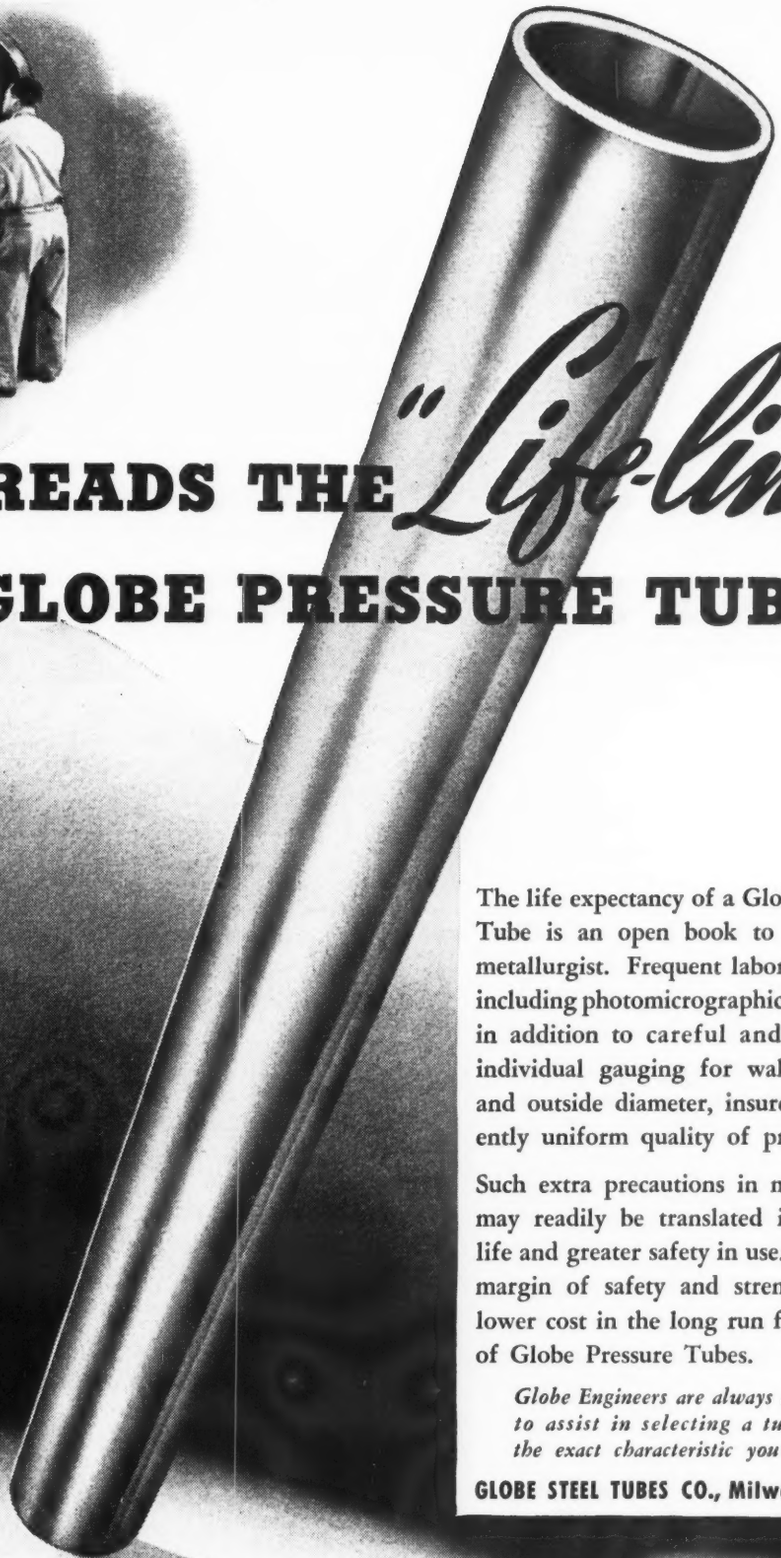

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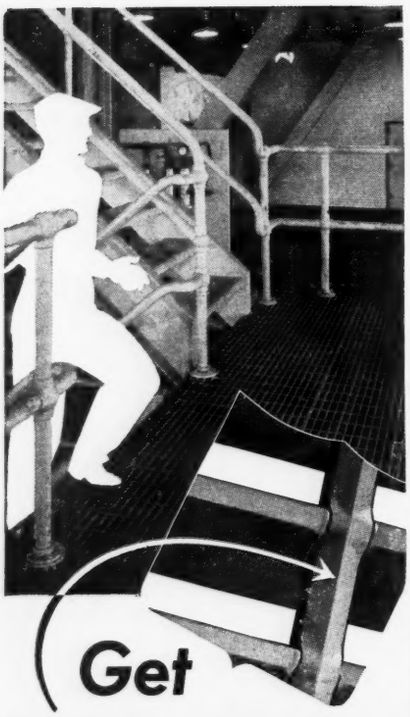

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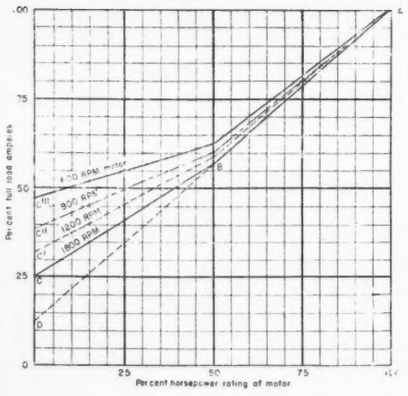

but has been used with practical results by several plant electricians for a number of years, and has been checked for accuracy with design data of motors. With this method it is not necessary to lose productive time, because the leads to the motor need not be disconnected to make the tests.

Here are the seven simple steps to be taken in using this method:

1. Plot a chart with "% hp" against "% full-load amperes" for each motor.
2. Locate point A as 100 percent from motor nameplate reading of amperes at rated hp of motor. (Also it is assumed that the nameplate voltage is maintained.)
3. Disconnect motor from load and read no-load amperes with ammeter and locate point C in percent of full-load current (approximately 25 to 45 percent depending on speed of motor).
4. Locate point D halfway between O and C and draw line DA.
5. Locate point B on line DA at 50 percent of the motor hp rating and draw CB.
6. Then line ABC will be the approximate curve of the percent horsepower output of the motor against percent of motor current.
7. For any motor current, read in amperes, calculate the percentage of the full-load current, follow horizontally until line ABC is intersected. Then drop down vertically and read the percent load of the rated hp of the motor.

If it is not convenient or feasible to disconnect the motor from the load as suggested in Step 3, then the no-load current can be taken from Fig. 1. For example, an 1800-rpm motor has a no-load current of approximately 25% which is the average for motors up to 100 hp. Lower speed motors have higher no-load currents, in the order of 45% of full-load current for 600-rpm motors.

It may be surprising to find that the no-load currents are as high as that shown in Fig. 1, but it should be re-

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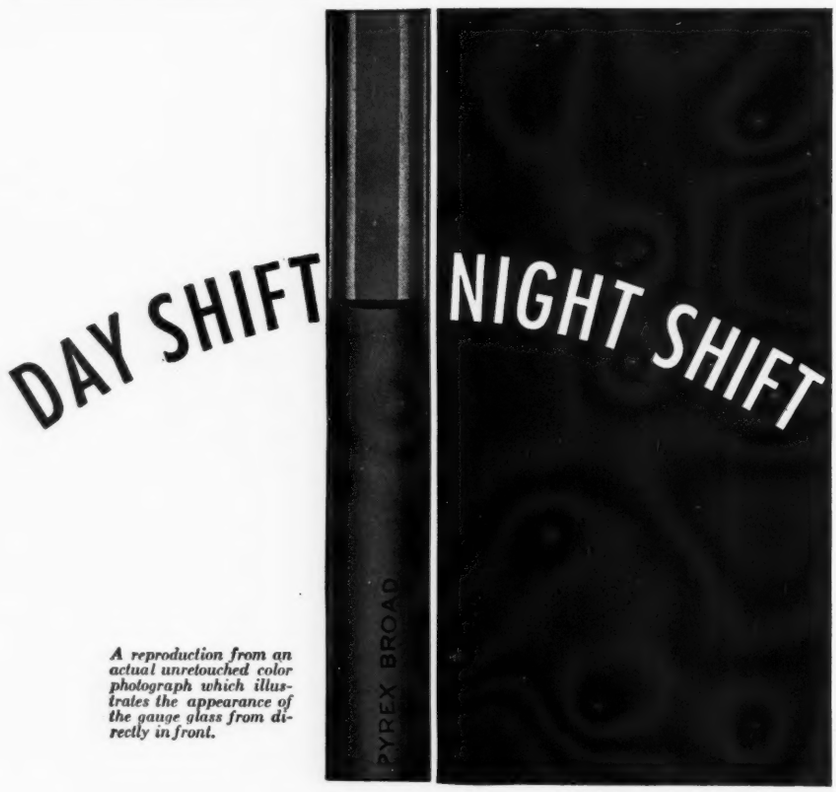

A reproduction from an actual unretouched color photograph which illustrates the appearance of the gauge glass from directly in front.

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membered that the no-load current is nearly all magnetizing current at practically zero lagging power factor and that the actual horsepower imput from the power system is very low. This accounts for the rather high currents below one-half load where the efficiency of the motor is also lower.

From one-half to full load, it can be seen that the motor current is roughly proportional to horsepower output because both efficiency and power factor are higher and more nearly constant.

Above full load, the current continues to increase in direct proportion to the load up to 125% of full load. This can be useful as a guide in carrying out wartime recommendations on increased motor loadings.

Thus we have a timely, practical, and time-saving way to determine the horsepower that an a-c motor is delivering just from an ammeter reading. Accuracy of between 2 and 3% can be expected, subject of course to the ammeter accuracy tolerance.

Another advantage to be obtained by the hook-on volt-ammeter is that the voltage applied to the motor can be read simultaneously with the current. It is obvious that a motor must have the proper voltage applied or the current will be too high and overheating will result. This will also give an indication of the loads on feeder copper and remedies applied.

It is hoped that this method will serve as an additional tool to help in the war program of utilizing all materials to the best advantage. Proper motoring is a patriotic necessity to conserve vital materials. Overmotoring is a tacit admission of insufficient knowledge of the machine and during wartime it is almost a crime.

Hoover Medal Award

Announcement has been made that Gerard Swope, president of the General Electric Company, New York, has been selected as the sixth recipient of the Hoover Medal, with the following citation:

"GERARD SWOPE, engineer and distinguished leader of industry, ever deeply interested in the welfare of his fellowmen, whose constructive public service in the field of social, civic and humanitarian effort has earned for him the Hoover Medal for 1942."

The Medal will be presented to Mr Swope during the Winter Convention of the American Institute of Electrical Engineers during the week beginning January 25, 1943.

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CASE HISTORY NO. 3. To eliminate *plunger scoring and stuffing gland leakage*, due to the accumulation of dried chemicals, %Proportioners, Inc.% now *Fluid Seal* both plungers and stuffing glands of their Adjust-O-Feeder chemical proportioning pumps, thus reducing mess and maintenance expense.

If you have a similar problem address—

% PROPORTIONEERS, INC. %

16 CODDING STREET, PROVIDENCE, R. I.

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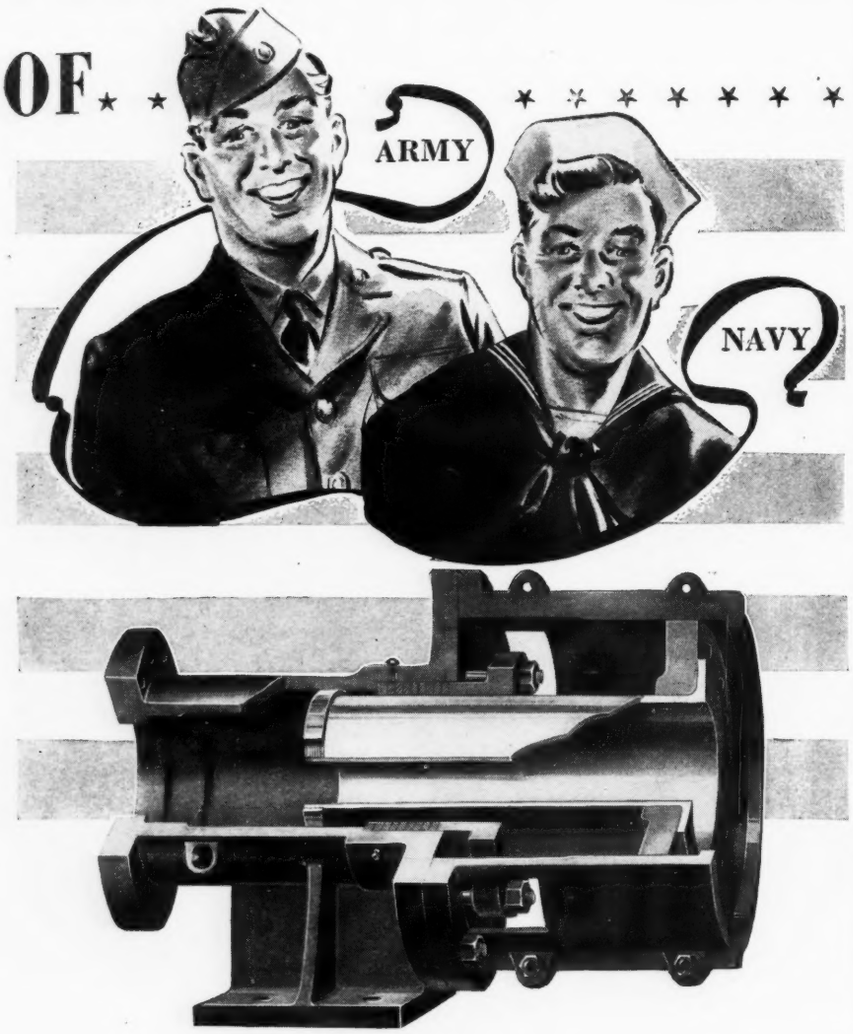

In Army and Navy Air Bases, army camps and in important defense plants, ADSCO Internally-Externally Guided Joints are safeguarding vital steam, hot water, fuel oil and gasoline lines. Completely guided, these joints meet Army and Navy specifications for controlling expansion and contraction in pipe lines. Approved by leading mechanical engineers.

Write for quotations, also Bulletin 35-20P.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.

Making "UP-TO-DATE" Steam Line Equipment for Over 60 Years

ADSCO INTERNALLY EXTERNALLY GUIDED JOINTS

consisting of representatives of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, and the American Institute of Electrical Engineers. It was formally instituted on April 8, 1930, during the celebration of the fiftieth anniversary of The American Society of Mechanical Engineers. "To honor engineers whose pre-eminent services have advanced the well-being of mankind and whose talents have been devoted to the development of a richer and more enduring civilization, the Hoover Medal is awarded in recognition and appreciation of those principles and ideals of civic obligation and of public service exemplified by the life and work of Herbert Hoover," to whom the first award was made.

Manning Tables

With formal release of a procedural outline for setting up individual-plant "manning tables," utilities and other essential war industries now have at their disposal the government's latest device for effecting an orderly withdrawal of draftable, key workers from war plants.

Hinted at and discussed informally for months, (*Electrical World*, Oct 17, 1942, pg 68) the plan is based on the blunt proposition that "needs of the armed forces will compel the eventual induction of practically all men who can meet the age, physical and other requirements; these men must be released by industry."

The manning table procedure is intended to provide "the basis for withdrawal of such workers at a rate that will allow others not suitable for active service to be trained to replace them."

Fundamentally, a manning table is a list of different jobs in a given plant, with each type supported by appropriate data. It records the type of worker needed to fill a specific job, the skill, training and experience needed to fill each job, essential characteristics workers need to do jobs properly, and the length of time required to train a replacement for any given job on the list. Obviously, the table which is left after management-government conferences bring approval for any specific proposal, will be a compromise.

After obtaining permission to participate in the plan, utilities draw up manning tables on forms provided by WMC and submit five copies to the regional WMC director. When validated, a copy of the plan is forwarded to the state Director of Selective Service holding jurisdiction. His approval

DON'T DO THIS TO YOUR VALVES!

Don't use a long lever and strong pull on any screwed joint, either. Avoid twisting the valve, by using a short lever and a few hammer taps.

At no time permit anyone to use a wrench on the valve hex farther from the joint. Valve bodies are strong but they are not designed to withstand that sort of strain. A twisted body—and a valve that will not operate—may very well be the result. . . . Remember, high pressure war production and allocation of critical metals have combined to make it difficult to get new valves. Guard those that you now have.

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In War Time, It's . . .

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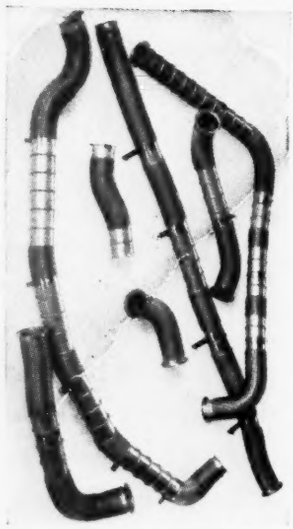
★ **Achieve design flexibility, conserve vital materials, speed conversion, assembly and production by utilizing flexible metal connections—specifically..**

REX *Flexible* METAL HOSE



Units Shown are Typical Vari-formed Assemblies.

The many production types of REX Flexible Metal Hose offer the widest range of adaptability—for simplifying re-design problems where space limitations and flexibility are imperative—for conserving more critical materials—for solving every kind of fluid and gas handling problem.

REX Flexible Metal Hose speeds manufacture by facilitating assembly. It can be bent to position or "snaked" into place and coupled in a fraction of the time required to fit multi-plane pipe connection. Easily attached fittings for every requirement. REX Flexible Metal Hose withstands severe flexing and vibration. All in the interest of war time economy.

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REX-WELD Corrugated Flexible Metal Hose • REX-TUBE Interlocked Flexible Metal Hose
REX-FLEX Stainless Steel Flexible Tubing • AVIOFLEX Oil Line Hose • CELLU-LINED Hydraulic Hose

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General Offices: MAYWOOD, ILLINOIS
Factories: Maywood and Elgin, Ill.

is required before the table will have any effect on any Selective Service activity.

On acceptance, the state director will assign the utility a state acceptance number which shall be listed on occupational deferment requests for all workers of military age, (Form 42A). This number will give local draft boards notice that the employer's plan for worker replacement has been drawn along approved lines.

Currently, even without a state acceptance number, Form 42A is written evidence of the occupational necessity of the registrant for whom it is filed. Thus far, board actions on these requests, however, have been so spotty as to bring considerable confusion.

Both Paul V. McNutt, WMC director, and Draft Chief Lewis B. Hershey hope for very definite changes in the present, uncoordinated methods with which local boards handle 42A requests. Both hope that voluntary use of manning tables will be so widespread as to send a flood of state acceptance numbers over local board desks. In such event, they feel that appearance of such a number on a request for occupational deferment would lead to more or less automatic granting of the requested deferment. This is expected particularly of local boards which deal with employes of large industrial plants, whose individual importance to the company can be known to board members personally only in relatively few instances.

Conversely, Washington is looking toward the day when a request for occupational deferment without an acceptance number will get correspondingly short shrift from the local board.

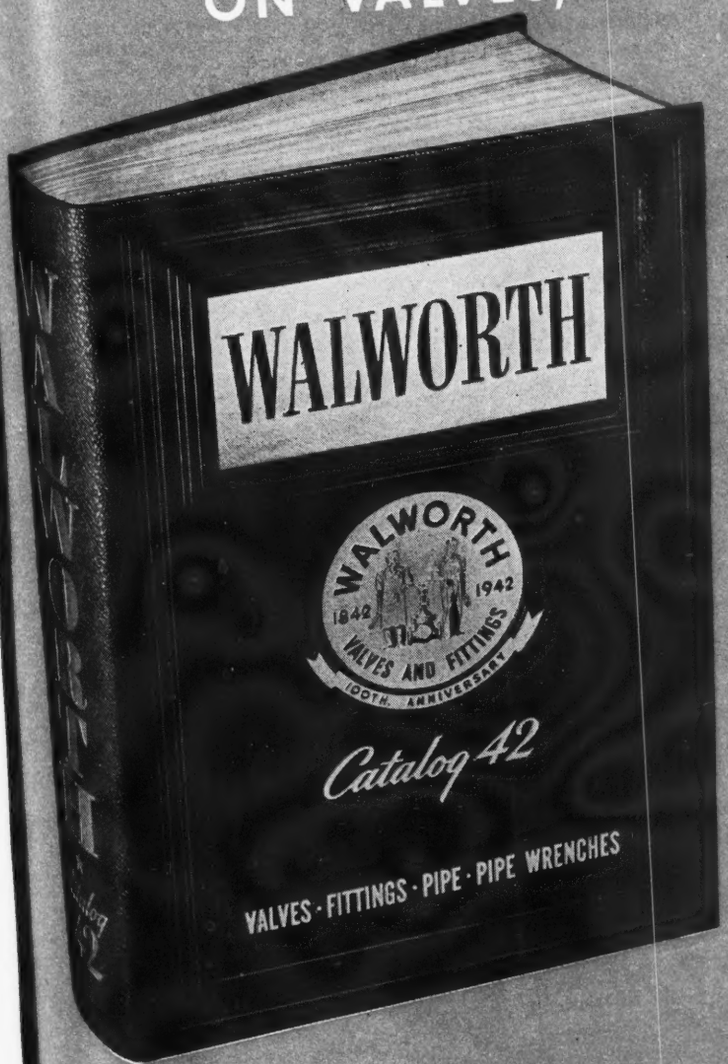
Although WMC for several months has been urging the use of manning tables on employers who sought its aid, this week's action was the first to throw the plan open to essential industries generally. Currently, it is open on a purely voluntary basis.

Meanwhile, WMC's technical committee, which took over establishment of lists of critical occupations from Selective Service, has scheduled a review of Occupational Bulletin No. 9, which classified the electric utility industry as essential and listed 86 occupations therein as critical.

Currently, the committee is finishing its general list of critical occupations. Thereafter, it will review that list and then begin reviews of the 12 occupational bulletins issued by Selective Service before WMC was organized. No decision on Bulletin No. 9 will be forthcoming for several weeks, according to authorities.

Specify FROM THE NEW WALWORTH Catalog 42 *and be sure!*

HERE'S THE COMPLETE UP-TO-DATE DATA ON VALVES, FITTINGS AND PIPE



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3. **DIMENSIONS**—complete for layout and operation with cross sections to clarify internal construction.

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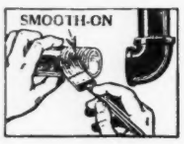
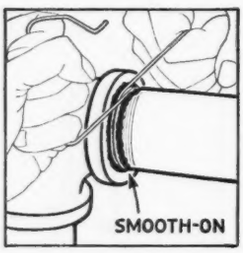
WORN PIPE FITTINGS

How to Make them **USABLE** *with* **SMOOTH-ON**

Today, it is essential to salvage used pipe and fittings for re-use whenever possible. You may find some fittings to have worn, corroded, or battered threads, but even such fittings can be made fully serviceable by means of Smooth-On No. 1.





This iron repair cement fills all voids between the threads, and expands as it hardens to form a lastingly tight joint, even under high temperatures and pressures. Smooth-On can be effectively used in this manner even if the fitting is a size larger than the pipe or nipple, as in the illustration below. Smooth-On will also stop a leak at a threaded joint without the necessity of disassembling and remaking the joint.

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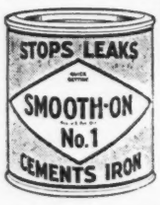
Simple, concise instructions for these and hundreds of other material-saving repairs to plant equipment and pipe lines are given in this 40-page practical repair manual. A war-time necessity in every plant. Your copy sent FREE if you fill in and return the coupon.



Get Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. can or in 25-lb. or 100-lb. keg from your dealer, or if necessary from us.

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12-42

Do it with
SMOOTH-ON

WPB Warns Copper Holders

Reports from almost 80,000 business firms have revealed 200,000,000 pounds of idle and excessive inventories of copper and copper base alloy products, and the government is instituting action in cases where holders have been negligent in filing reports, or refuse voluntarily to sell their materials for war use.

This was announced Nov. 12 by Col C R Baxter, A.U.S. Chief of the Materials Redistribution Branch of the War Production Board, who emphasized that "the substantial numbers of United States forces now engaged in operations against the enemy obviously mean increased demand for munitions and other implements of war for which copper is vitally needed."

Col Baxter revealed that 125,000,000 pounds of copper have been voluntarily offered for sale, and 93,000,000, or approximately 75% of it, has already been allocated to war production.

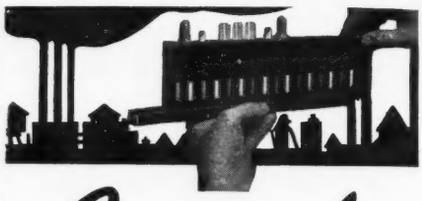
Of the total offered for sale, 26,800,000 pounds so far were moved in existing form to war use by direct sales under Priorities Regulation 13; 17,800,000 pounds were reported and allocated as scrap; 44,555,000 pounds were allocated to brass mills and ingot makers for remelting. An additional 25,000,000 pounds will be allocated to war use as quickly as purchase contracts, which have been sent to holders, are returned.

Holders of 64,000,000 pounds of copper have thus far refused to sell their idle and excessive materials, however, and the government, Col. Baxter stated, will institute requisitioning action whenever necessary.

"Many firms—and some of them very important ones—have not yet sent back their inventory reports to the Copper Recovery Corporation, Agent of Metals Reserve Co. despite follow-up letters and wires." Col Baxter said. Whether or not these firms actually hold copper stocks—and we believe many of them may be large holders—it is necessary that they file reports; otherwise this program cannot be speedily completed.

"We are glad to repeat that the majority of holders are giving this program their full and complete cooperation. It is our desire to keep this program on a voluntary basis. However, we shall institute requisitioning actions in all instances where materials are vital for war use and holders refuse to sell."

War producers are urged to use the facilities of the Copper Recovery Cor-



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Keep your steam generating equipment in constant top-notch condition, assure economical, high-efficiency operation and eliminate time-wasting, costly descaling jobs by using the Taylor Boiler Water Comparator. Determines the pH and phosphate content of your boiler water in less than 2 minutes. Absolutely accurate — thousands in daily use attest its need in the modern boiler room. All Taylor Color Standards carry an UNLIMITED GUARANTEE AGAINST FADING!

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FIRE BRICK CEMENT

They write: "We have to-date reset three of the front walls of the 1,000 h. p. Edgemoor Boilers with this cement . . . One of these walls has been in operation now for nearly a year and the *best we were able to do with fire-clay previously in these walls was about three or four months.*" ADAMANT has a bonding strength of 800 lbs. per sq. in. at room temperature; 1270 lbs. per sq. in. at 2600° F. This has been proved by impartial tests made by one of the leading technical institutes of the country. Write for the complete facts about ADAMANT—now.

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A whole year's tips on a handy tag...
TO GO WHERE IT'S NEEDED MOST

HOW TO MAKE WIRE ROPE LAST

INSTALL PROPERLY

Avoid kinks by proper unreeling and uncoiling:

Mount reel on jacks or substantial cribbing.

Roll coil along floor.

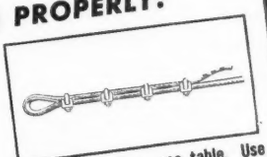
SPOOL CORRECTLY THE FIRST TIME:

Wind all wraps on tight.
Make each turn fit snug.
Do not interlock strands.

PUT CLIPS ON PROPERLY:

NUMBER OF CLIPS REQUIRED FOR "BLUE CENTER" STEEL WIRE ROPES

Rope Diameter	Number of Clips	Spacing of Clips	Length of Wrench
½" to ⅝"	4	3½" to 4¼"	12"
¾" to ⅞"	5	5" to 5¾"	18"
1" to 1⅛"	6	6½" to 7¼"	24"
1¼" to 1⅜"	7	8" to 8¾"	24"
1½"	8	9½"	24"



Use enough clips — see table. Use a wire-rope thimble. Put U-Bolts on dead end of rope. Retighten clips after running one hour.

ALL THROUGH 1942, our advertising has brought you much valuable information on how to install wire rope, how to maintain and inspect it, how, in brief, to make it last as long as possible.

Many of you executives and operating men have expressed a desire to pass along this information in simple, handy form to your men who really handle the rope, so they'll be able to use it right on the job.

Here they are—a whole year's tips on wire-rope conservation — on a sturdy, convenient tag you can have fastened right to equipment, on controls, or to the wire rope itself.

Printed on heavy stock and varnished for further protection, the tags are ideal for use right on the job — durable, washable, always legible. And they're yours for the asking! *WRITE FOR "TAG A".*

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Because it has become impossible for us to meet the ever increasing demand for Wilson Tube Cleaners and Wilson tube cleaning accessories in our plant at 47-28 37th Street, Long Island City, N. Y., we have purchased the building shown in the above photograph.

In our new home we will have available over three and one half times the floor space we had in our former plant. We have installed many new high speed machine tools and the greatly increased production capacity which these additional machines are giving us enable us to make more Wilson Tube Cleaners and accessories and also to make quicker shipments.

Write for the name of our representative nearest to you or ask for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.

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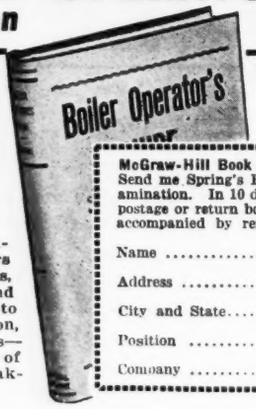
Helps you meet everyday problems; Prepares you for license exams

With hundreds of typical examination questions and answers as well as complete instructions, this book presents fully and plainly the things you want to know about proper installation, operation, and care of boilers—the things that prevent dollars of loss in reduced efficiency, breakdown, or even accident.



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poration, 200 Madison Avenue, New York, New York, in filling emergency shortages of copper in various forms. A national inventory of all copper products reported in idle and excessive inventories is maintained there. The special unit of WPB's Copper Branch, located in the Copper Recovery Corporation, continues to receive emergency requests at the rate of 500,000 pounds per day. More than half of these requests are being filled from idle and excessive inventories, where materials are located in the exact form needed, private sales arranged, and shipments made at once.

Heat Flow Through Building Walls

R H Dearborn, dean of the School of Engineering at Oregon State College, Corvallis, and F C McIntosh, Pittsburgh, Pa., Chairman of the Committee on Research of the American Society of Heating and Ventilating Engineers, announce the consummation of a cooperative agreement to investigate the heat flow through wet building walls.

The research program will be carried on in the domestic heating laboratory of the College at Corvallis by means of a specially constructed apparatus in a study jointly planned by Prof Earl C Willey of the College and the research committee of the Oregon Chapter of the Society, of which Edwin W Neubauer of Portland is chairman. Various types of building wall sections will be constructed and tested under conditions simulating heat loss during rainy weather.

"The results of the investigation", said Mr. Neubauer, "should be of particular interest for application in the Pacific Northwest in which building walls are wet during much of each winter season. Incomplete information on heat loss through wet walls is available at present for accurate determination of heating plant requirements".

The laboratory at the college is part of the Department of Mechanical Engineering in the School of Engineering, of which Prof S H Graf is the head. Professor Willey is in charge of the heating laboratory and will have direct supervison of the project which is part of the research program of the Engineer Experiment Station. The Society's Oregon Chapter, of which Bert W Farnes of Portland is president, will act in an advisory capacity in connection with this research project which will be of widespread interest to engineers.

Dearborn Engineer does this for you . . .
(1) *Studies* your water and plant operating conditions.
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(3) *Recommends* proper chemical treatment and chemical control methods.
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To be of greatest assistance to you, the Dearborn Engineer is purposely located nearby so that he may be in your plant quickly in an emergency and frequently on regular calls for consultation and check. Back of him is the experienced Dearborn laboratory to supply the facilities for developing corrective measures and to design the system of control. If you are not already using this service, write to us . . . we'll gladly arrange for the Dearborn Engineer to call on you. DEARBORN CHEMICAL COMPANY, Dept. D, 310 S. Michigan Ave., Chicago.

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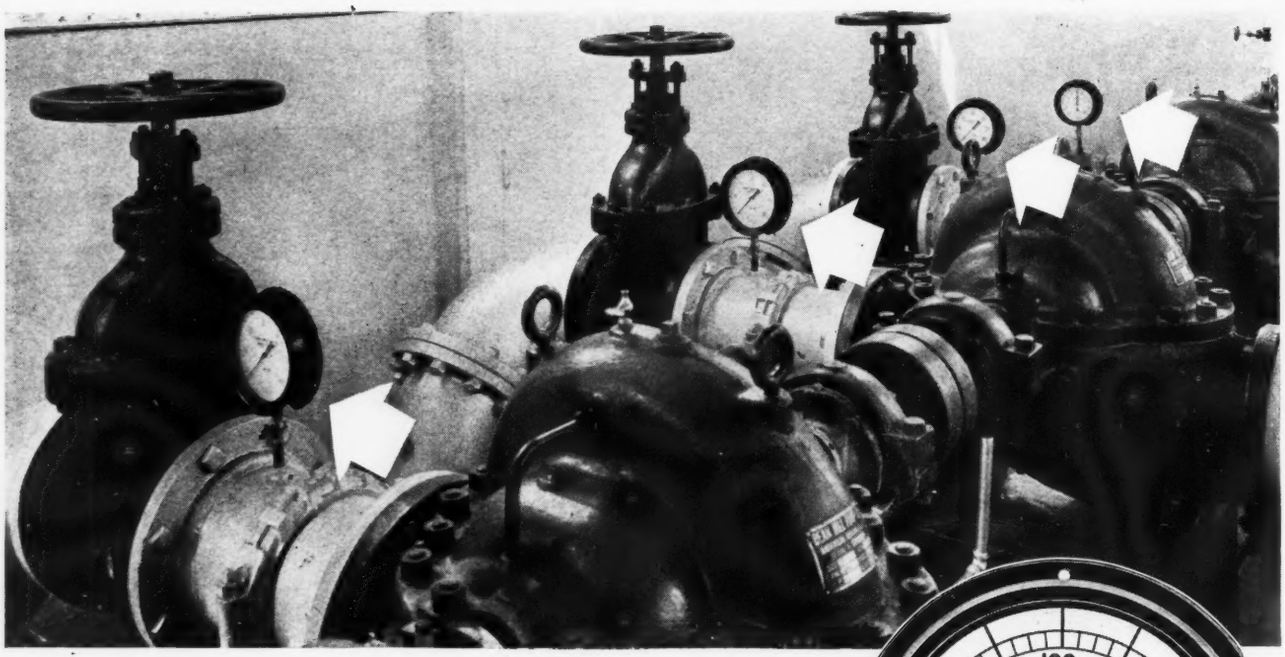


"It takes Marsh to build a gauge that will stand up!"

AN operating man said that, and he expressed what hundreds of other practical men have found out about gauges, namely this:

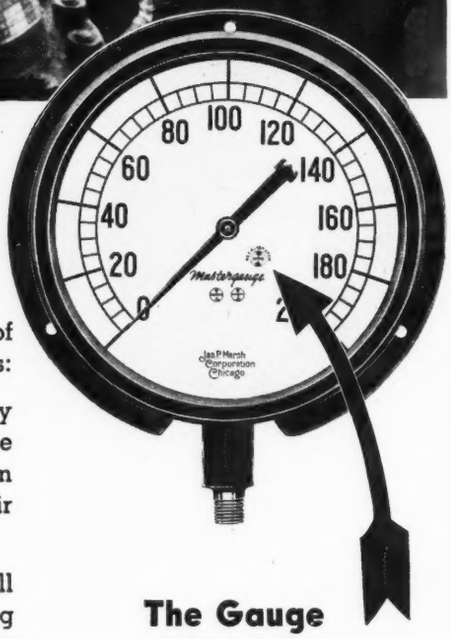
When gauges are new they look a good deal alike, and when they first go into service they work a good deal alike. But under the punishment of daily service you'll find that MARSH Gauges begin to stand out as the kind that can take it and still maintain their original accuracy.

The fact is that it's comparatively easy to make a gauge that will start out accurate, but it takes the knowing design, the careful testing of materials, and the painstaking workmanship taught by 75 years of Marsh specialization, to make a gauge that will *stay* accurate.

And Marsh Gauges not only possess more stamina; they also have the Marsh "RECALIBRATOR"—the only basically sound way to restore accuracy in a gauge when it is thrown out of adjustment by overload or severe shock.

The good attributes of Marsh Gauges, including the "Recalibrator", are found in Marsh Dial Thermometers. There is a Marsh Gauge, Thermometer, or Recorder for practically every pressure or temperature measurement requirement.

JAS. P. MARSH CORP., 2075 Southport Ave., Chicago, Ill.



The Gauge with the "RECALIBRATOR"

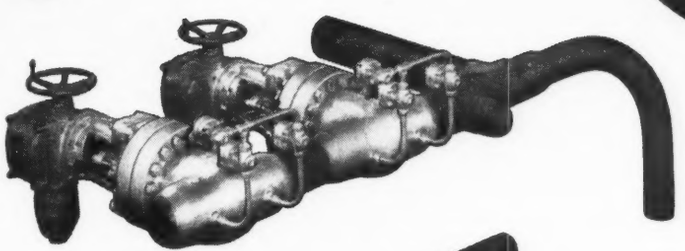
● The Marsh reputation for building superlative gauges has been further heightened by the introduction of the Marsh Mastergauge, illustrated above. Here is a gauge that gives new meaning to accuracy and stamina under the most extreme service conditions. The "Recalibrator", pointed out above, is available in all Marsh Gauges and Dial Thermometers.

MARSH GAUGES

DIAL THERMOMETERS ★ RECORDERS ★ HEATING SPECIALTIES

The oldest manufacturer—the newest ideas

PRE-FABRICATED PIPING IS BETTER PIPING



Pre-fabricated piping is delivered to the job as a series of sub-assemblies that permit easy, rapid and economical installation. It is prepared in a plant employing experienced mechanics and pressure welders whose work can be insured. Layout tables, form cutting machines, work rotating fixtures, straightening tables, preheating and stress relieving equipment, testing facilities, etc. (not usually available in the field) offer further assurance of superior quality.

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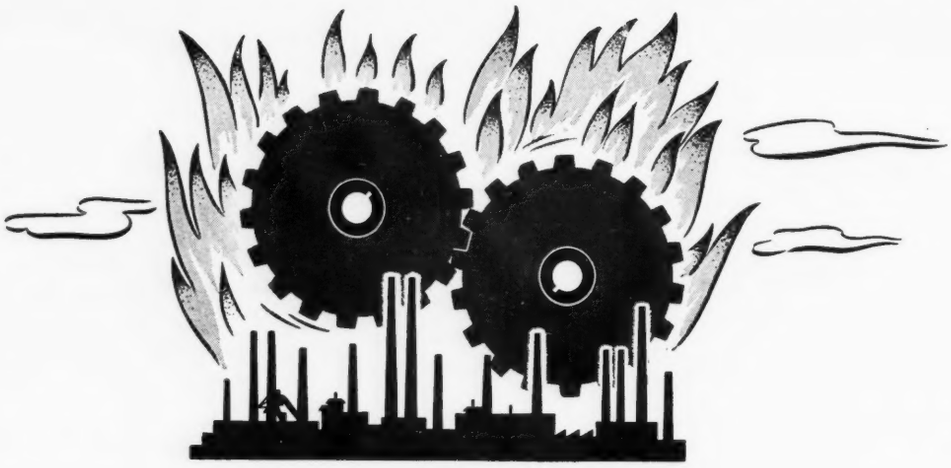


MAKING IT HOT FOR THE AXIS

ON AMERICA'S MIGHTY PRODUCTION FRONT

WANT to know what "Made in America" means in Tokio, Berlin and Rome, these days? Ask Doolittle! Ask the flying Tigers! Ask our fighting men and allies everywhere! With each passing day, more American-made planes . . . guns . . . tanks take their toll on every battlefront — and plenty more are on the way! In a war of machines, America's production front smashes ahead at top speed — is rapidly strengthening American armed might for the final all-out assault on the Axis.

Behind today's manufacturing achievement is the story of America's *power* production — for mine, mill, factory, assembly line. In power plants of every type, as well as in fighting and merchant ships, over 50,000 Todd units are contributing their full share of this basic horsepower — hanging up new records everywhere in the efficient combustion of liquid and gaseous fuels.

Todd technical service staffs, stationed in key cities . . . with parts and replacements instantly available . . . are helping to maintain uninterrupted power for America's mighty production line.

TODD COMBUSTION EQUIPMENT, INC.

(Division of Todd Shipyards Corporation)

601 West 26th Street, New York City

TODD NEW YORK, U.S.A.

NEW YORK MOBILE NEW ORLEANS GALVESTON SEATTLE BUENOS AIRES LONDON

For Victory . . . Buy U. S. War Bonds and Stamps

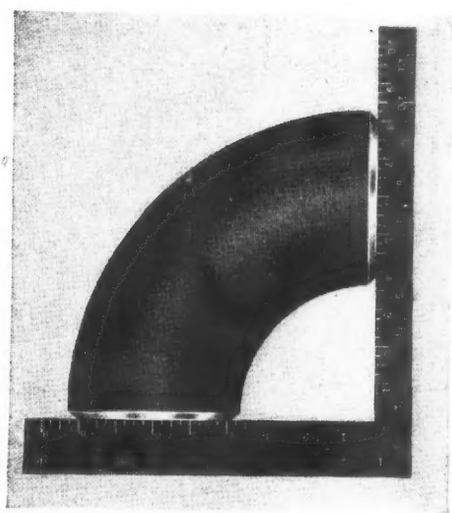
HOW TO SAVE TIME ON YOUR WELDED PIPING

Use MIDWEST WELDING FITTINGS

Now that "time" is the critical factor on so many welded piping jobs, it is more important than ever before to utilize the time-saving characteristics of Midwest Butt-Welding Elbows.

Qualified pipe welders report that Midwest Elbows save time and trouble on the job because they are always accurately to dimension . . . and because they are always uniform. Time is saved not only in lining up and in welding, but also because all pipe can be cut in advance according to drawings. Another important advantage is that more uniform welds are assured.

These features result from the design and from the unique process used in the manufacture of Midwest Welding Elbows. They are first made slightly oversize . . . then accurately sized in compression at a forging heat. Special fixtures and machine tools assure accurate finishing. Ask for Bulletin WF-41 which gives all the facts.



(above) Exact included angle is the result of special fixtures and tools developed by Midwest for machine-beveling the ends.

(right) Sectional view emphasizes uniform wall thickness and true circular cross-section of all Midwest Welding Elbows (both Standard and "Long Tangent").

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 So. Second St., St. Louis, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—949 Marquette Bldg. • New York (Eastern Division)—30 Church St. Los Angeles—520 Anderson St. • Houston—229 Shell Bldg. • San Francisco—535 Call Bldg. Tulsa—533 Mayo Bldg.

MIDWEST WELDING FITTINGS SAVE TIME, IMPROVE THE DESIGN, AND REDUCE THE COST OF PIPING SYSTEMS

A Switch in Time Saves..

By switching to POWELL Iron Body Valves wherever they will serve as effectively as bronze, you will help conserve these critical metals . . . . . .

Fig. 480—All Iron "Pilot" Gate Valve. Screwed ends, outside screw rising stem, bolted flanged yoke, taper wedge solid disc. Made in sizes ½" to 3" inclusive, for 125 pounds W. S. P. Also available with Iron Body Bronze Mounted—Fig. 478.

Before the war made copper and tin virtually "precious metals," many buyers and users of valves automatically thought in terms of bronze. Apparently the impression existed that the desired service could be obtained only by using valves with bodies made of this alloy.

But now the necessity for conserving the more critical non-ferrous metals has brought the realization that iron body valves — especially Iron Valves by POWELL — will in many installations serve just as effectively as bronze.

So when you specify POWELL Iron Valves you not only render a patriotic service but, because of the lower priority rating required, you can expect earlier delivery and—YOU'LL HAVE SAVINGS TO INVEST IN WAR BONDS.

The Wm. Powell Co.

Dependable Valves since 1846

Cincinnati, Ohio

POWELL

COPPER *and* TIN

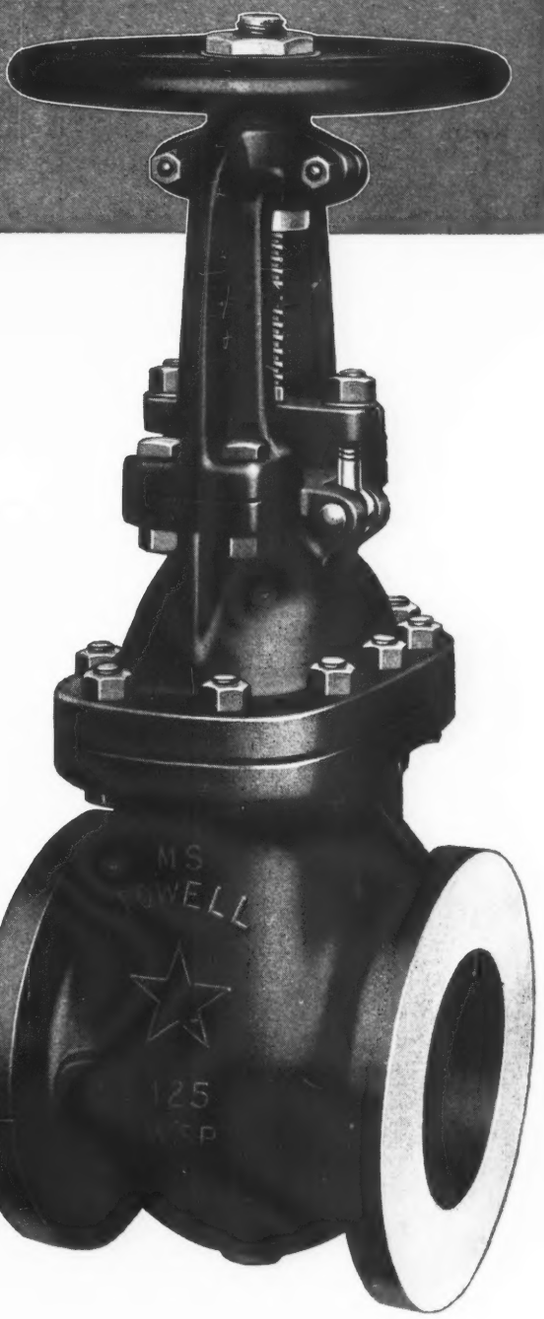
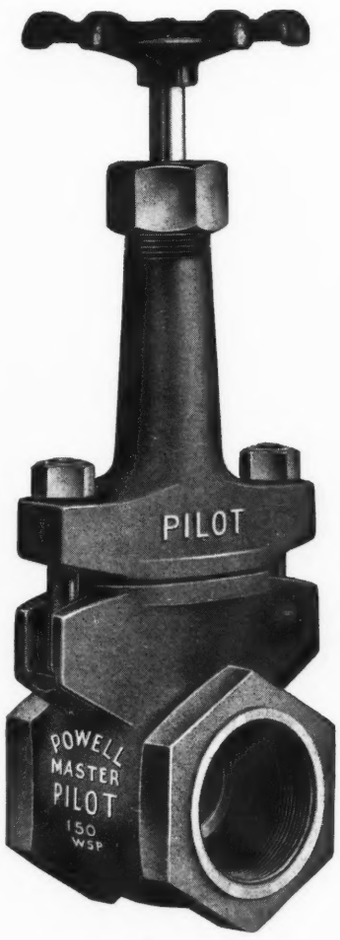


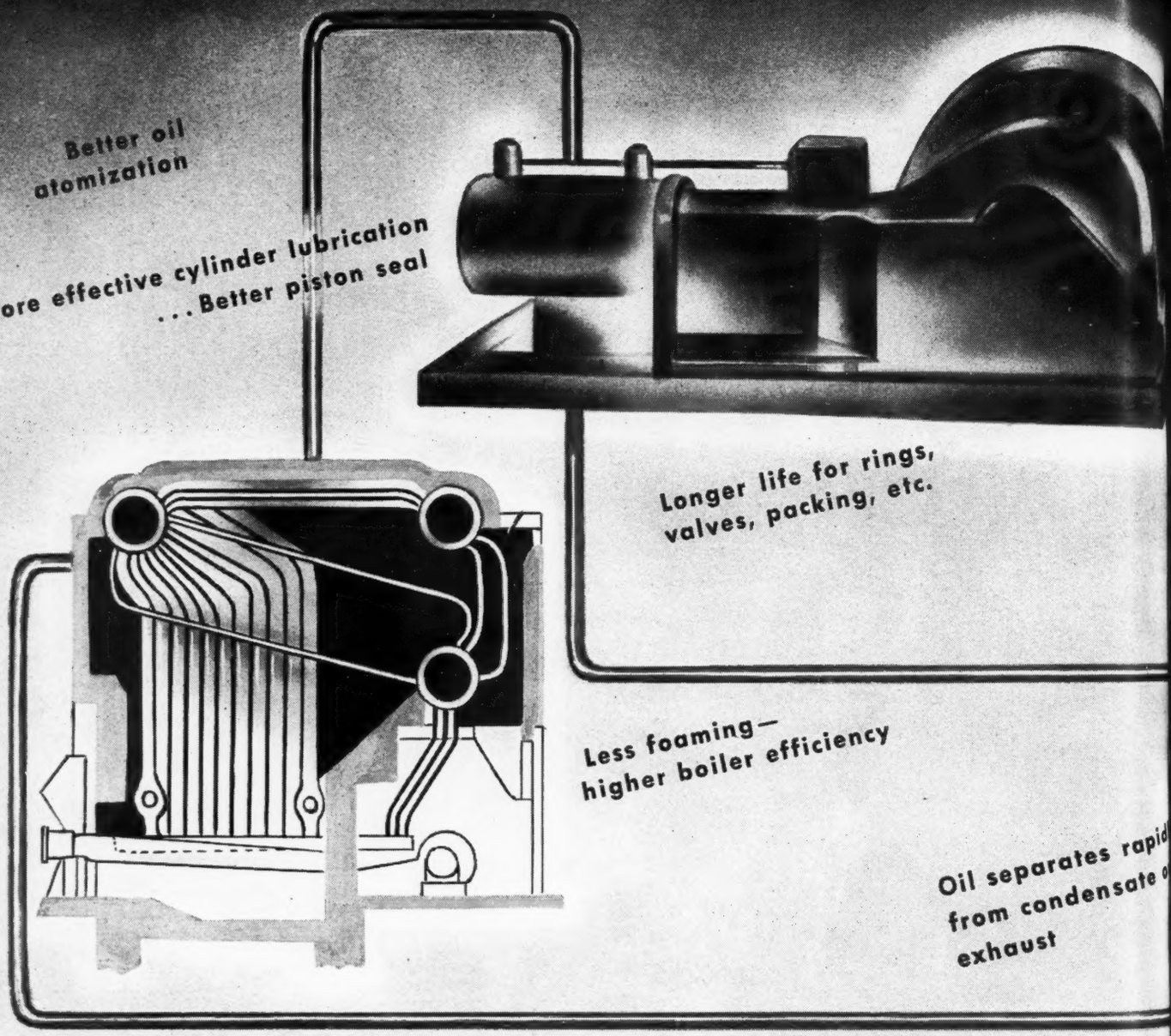
Fig. 1793—Iron Body Bronze Mounted "Model Star" Gate Valve, with flanged ends, outside screw rising stem, bolted flanged yoke, bronze renewable seat rings and taper wedge solid disc. Sizes 2″ to 30″. Available with taper wedge double disc (Fig. 1444) in sizes 2″ to 12″. Also made in All Iron—Fig. 1453 with double disc; Fig. 1816 with solid disc.

Fig. 1460—Iron Body Bronze Mounted "Master Pilot" Gate Valve, with screwed ends, rising stem, bolted bonnet and taper wedge solid disc. Made in sizes ¼″ to 2″ for 150 pounds W. S. P.; 2½″ to 4″ for 125 pounds W. S. P. Also available in All Iron—Fig. 1462.



VALVES

STANDBYS ONCE.. T



Better oil atomization

More effective cylinder lubrication ... Better piston seal

Longer life for rings, valves, packing, etc.

Less foaming— higher boiler efficiency

Oil separates rapid from condensate o exhaust

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

TEXACO

TEXACO

.. THEY'RE WAR WORKERS NOW!

DRAFTED for active war duty, hundreds of standby steam engines are being kept on the line . . . delivering full power with the aid of *Texaco Steam Cylinder Oils.*

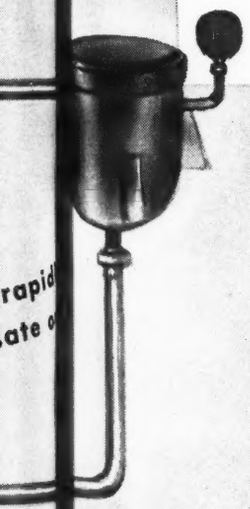
Whether *your* reciprocating steam engines are old or new, whatever the conditions of temperature and pressure, there is a *Texaco Steam Cylinder Oil* exactly suited to your needs.

The selected *Texaco Steam Cylinder Oil* will atomize completely, adhere to cylinder walls, separate rapidly from the exhaust; will assure quiet operation, low oil consumption.

The outstanding performance that has made Texaco preferred in the fields listed below has made it preferred by prominent steam engine operators everywhere.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate in selecting the most efficient lubricants for your plant . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write to:

The Texas Company, 135 East 42nd Street, New York, N. Y.



THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

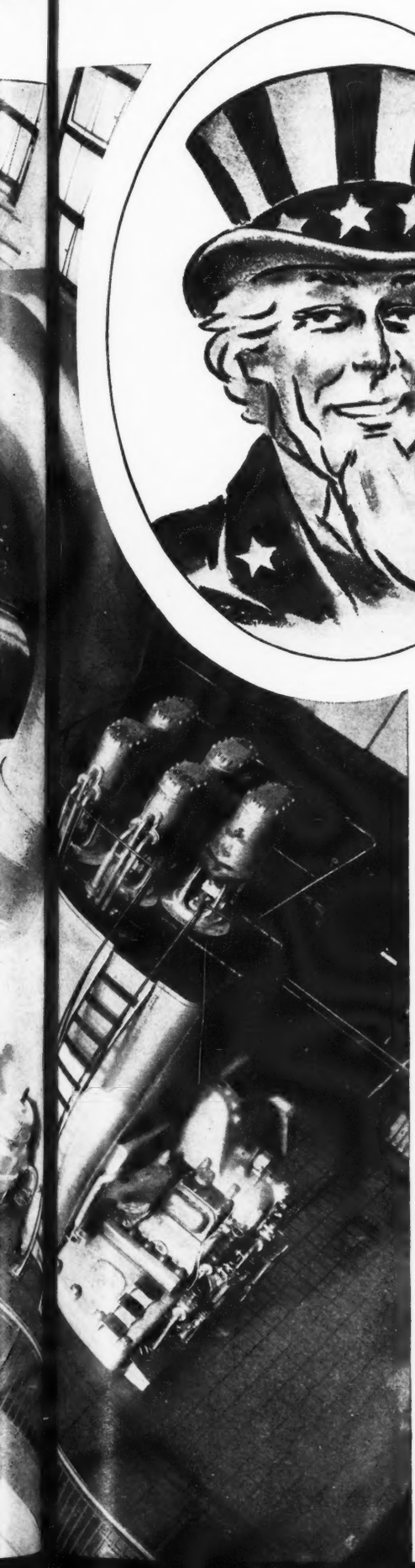
HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Lubricants and Fuels

FOR POWER PLANT EQUIPMENT

The Utilities

Uncle Sam's Unsung Heroes!



PEARL HARBOR touched off the fuse that blew the might of America into action.

New shipyards sprung up overnight. Tank plants mushroomed. Facilities for making munitions were multiplied, again and again. Plane plants doubled, tripled, quadrupled in number.

America's giant automobile and truck industries were converted to war work in record time. New additions were added, new plants, complete new towns sprung into being on America's industrial horizon almost overnight, creating an unprecedented peak in power demands.

The utilities met this CHALLENGE!

Power and MORE POWER for PRODUCTION became the goal of every utility—became the password of every lineman, of every electrician, of every office worker, engineer and executive in every American Utility.

We, of American Blower, who have been privileged to work with many of the nation's leading producers of power down through the years, are proud of the war record of American Blower Fluid Drives (Hydraulic Couplings), Fly Ash Precipitators, Forced and Induced Draft Fans in the able hands of America's Utilities—Uncle Sam's unsung heroes.

Now we proudly fly the United States Army-Navy "E" for production.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.

CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

Division of AMERICAN Radiator and Standard Sanitary Corporation

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Getting Most Out of Your Condenser Tubes During This Emergency

Bridgeport Engineers Report Practical Precautions That Help Extend Service Life of Present Tube Installations

In these days the importance of getting every possible ounce of usefulness out of condenser tube installations is fully recognized. Ways to avoid or eliminate the principal factors which contribute to condenser tube failures must be given prompt and serious consideration by every operator. Likewise, sound methods already being followed by many operators to conserve tube life should be publicized further so that *all* operators may obtain direct, practical benefits from the proven experience of others. The following information, assembled and verified by Bridgeport condenser tubing engineers and laboratory technicians, is reported here for convenient reference.

Types of Tube Failures

Generally speaking, the common causes of Condenser Tube failure are as follows:

1. Impingement attack or inlet end corrosion.
2. General dezincification.
3. Thinning.
4. Pitting.

In the case of inlet end corrosion or impingement attack the presence of air in the circulating water in the shape of fine bubbles is a prolific source of trouble. The more turbulent the circulating water the more air is released and the greater the wear on the tubes. Air action is always most marked at the inlet end of the tube. Therefore it is found that impinging or pitting action of air bubbles occurs two or three inches on the inside of the tube.

Reducing Air Impingement Corrosion

Prior to the war, Aluminum Brass Tubes were recommended to withstand this type of attack. Now, however, due to the shortage of certain critical materials, this particular alloy among others is no longer available for surface condenser work. To help fill the breach in this emergency, a very efficient device known as the Air and Erosion Eliminator has been perfected. This device consists of a number of perforated steel plates properly positioned at the inlet end of any pass or passes in a condenser through which the circulating water must go before the water continues through the tubes. The air released by the passage of the water through the perforations collects at the top of the water space from which it is removed by a series of semi-venturi nozzles which are in turn aided by a partial vacuum on the end of the manifold to which the nozzles are connected. This device now in use in many power stations is worth investigating.

Another item which has been used to combat this type of corrosion is the so-called Flowrite which is a flared sleeve or tube which is inserted into the inlet end of each tube, thus completely renewing the worn surface. These inserts are very carefully made for a tight fit in the tube and the inner end of the sleeve accurately reamed to insure smooth fit and water flow.

Rehabilitating Condenser Tubes

A practical procedure practiced by some operators is to remove the tubes from the condenser and have them stretched so that bad ends can be cut off and the tubes replaced in the condenser. This operation is being regularly carried on by companies thoroughly familiar with the procedure and it has resulted in operators being able to continue in service many tubes which, otherwise, would have to be discarded.

In the matter of retarding dezincification and pitting, condensers should be kept clean at all times and should be regularly shot with rubber plugs to remove any sludge or particles lodged on the inside of the tubes. Many operators have tried hanging zinc blocks in the water boxes, thereby directing the attack toward the zinc rather than into the tubes and quite recently we have heard of some operators hanging cast iron plates in the water box for the same purpose.

Bridgeport Arsenical Admiralty and Muntz

In this connection we have found that the addition of arsenic to Admiralty or Muntz Tubes definitely retards dezincification. That is why, unless otherwise specified by the customer, standard Bridgeport Admiralty and Muntz condenser and heat exchanger tubing are alloyed with arsenic.

Special care should be taken to make sure that your water conditions are satisfactory, such as dredging and renewing screens at the intake tunnel.

Many experiences are coming to the attention of the Bridgeport engineers and laboratory technicians in these times which may be of direct help to you on your particular problem. If we can be of any assistance, write us relative to your problems and we will try to investigate to see if other operators have had similar experiences and pass on the benefit of these experiences to you.

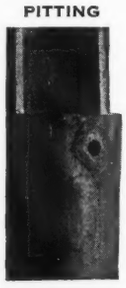
Too much cannot be said on the subject of conserving critical materials. Every operator, therefore, should do everything possible to prolong the life of his condenser tubes and we here at Bridgeport are always willing and ready to be of service.

Examples of Common Causes of Condenser Tube Failure

AIR IMPINGEMENT

DEZINCIFICATION

PITTING



Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

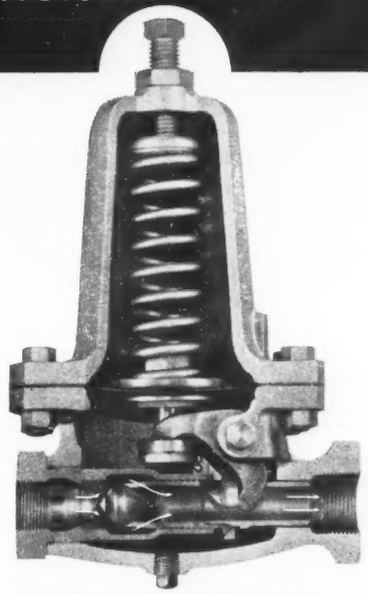
BRIDGEPORT BRASS COMPANY, BRIDGEPORT, CONN. *ESTABLISHED 1865*

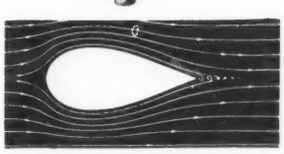
CASH STANDARD *Streamlined* REDUCING VALVES

TYPE 1000 PRESSURE

THEY'LL SEE YOU THROUGH WITH *Non-Stop Production . . .*

● Smooth, speedy, non-stop production is a vital thing today. It's a great advantage to have the dependability of operation—the smooth, even flow of steam, air, or oil—the better pressure control and greater capacity obtainable with the "1000" Valve. The Streamlined flow pattern you see at the right pictures for you the kind of valve action you get that is an important factor in keeping things going on your production front. Years after they have been installed, "1000" Valves perform so that you continue to realize all of the twelve benefits listed below. The "1000" is known as the "NO TROUBLE" Valve.





HERE'S THE "1000" FLOW PATTERN
The Streamlined form of the inner valve eliminates turbulence. It produces the flow pattern shown above which makes for maximum capacity when it is needed most and permits accurate pressure control under toughest working conditions.

POINTS THAT COUNT BIG IN YOUR FAVOR

You get all Twelve . . .

1. Maximum Capacity when needed most
2. Accurate Pressure Control under toughest working conditions
3. Trouble-free Service
4. Smooth Operation
5. Tight Closure
6. Accurate Regulation
7. Speedier Production Results
8. Elimination of failures
9. Constant Delivery Pressure
10. Cost Saving Operation
11. No Spoilage
12. Practically zero in maintenance costs

You can find out full details on all of the Type 1000 benefits by reading Bulletin "1000" —send for it!

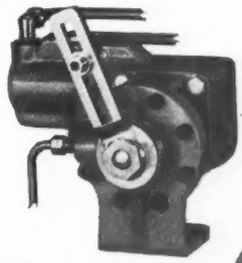
New CASH STANDARD *Remote* HYDRAULIC *Control*

●

Transmits oscillating motion without mechanical linkage

TYPE 550 SENDER

●Primarily used by aircraft manufacturers and aeronautical laboratories on engine test cells for controlling throttle position and mixture — this Type 550 Remote Hydraulic Control may fit your needs too. It is good for use where you desire to control apparatus remotely—without mechanical linkage. To operate, depress button in control lever with thumb. This releases the automatic brake. Move control lever to any desired position: release button, and control is automatically locked in that position, where it will remain indefinitely. The unit — A Type 550 Sender (above) and Type 550 Receiver (below), has positive hydraulic power in both directions — no springs, no cups on pistons. It transmits the total force applied to the control lever. There is no lost motion in either direction. The lever of the Receiver moves 90 degrees. It can be indexed to any position. For easy mounting, the bracket of the Receiver can be indexed to four positions. The Receiver can be installed above or below the Sender.



TYPE 550 RECEIVER

Write for Data

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES

FOSTER ENGINEERING COMPANY
FOSTER AUTOMATIC VALVES
ESTABLISHED 1879

for Accurate REGULATION OR CONTROL

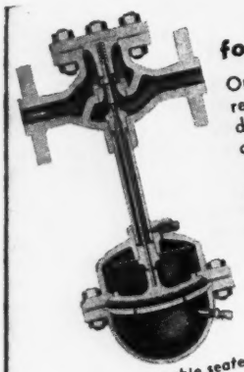
PRESSURE REDUCING REGULATORS

for STEAM, LIQUIDS, GASES

One of the latest developments in pressure reducing regulators — an air-loaded dome design for the accurate regulation of high and low pressure fluids.

Built for initial pressures up to 2500 lbs. per sq. in. and temperatures up to 1000° F., this valve will handle pressure reductions of a magnitude previously impractical in a single stage.

There are no operating springs in this simple, single-seated regulator. A constant loading is imposed by air, thereby insuring constant regulation. Accuracy is unaffected by spring deflection and hysteresis.



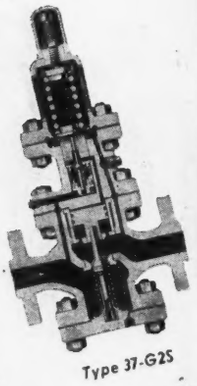
Type 39-Q1. Double seated
Type 39-Q2 also available

for STEAM

Built for pressures up to 1500 lbs. and 900° F. total temperature, the improved Foster Type 37-G2 Pressure Reducing Regulator assures accurate regulation despite widest variations of initial pressure.

Single-seated for dead-end service, both pilot and main valve are protected by internal strainers from pipe line sediment.

Streamlining of body distributes and assures free flow of steam, while construction of main valve provides maximum lift to minimize pulsating and wire drawing—affords graduated flow and modulating control. Can be fitted with locking cap or hand wheel.



Type 37-G2S

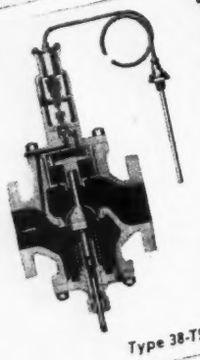
TEMPERATURE REGULATORS

The Foster Type 38-T9 Temperature Regulator is an internally pilot-operated, piston-actuated valve for controlling temperatures within ± 1° F.

Single-seated for dead-end service, this regulator is built in sizes of 1/2 to 12 inches for pressures of 25 to 450 lbs., and for temperatures up to 300° F.

An essential feature of this design is that with relatively little temperature change (± 1° F.), the valve will travel from closed to fully opened position.

This regulator also is equipped with a temperature over-travel protective device.



Type 38-T9

STEAM SIREN

This siren can be heard for miles, and works fast—its rising sound pitch or howl reaches its peak in from three to five seconds, depending on the maximum pitch for which this siren is set. It can be used for signaling because of its sharp sound cut-off.

If a constant pitch is desired, this siren can be so ordered or factory converted into a revolving cylinder-type of horn which produces practically a single pitch from starting to full speed as contrasted with conventional rising pitch or howl.

Type 45
A smaller size—
Type 30—available

- REDUCING VALVES
- TEMPERATURE REGULATORS
- PUMP GOVERNORS
- SIRENS
- ...plus eight sections of useful engineering data

The above shows but four of the scores of Foster Automatic Valves described in our new complete catalog. Write for your copy, on your company's letterhead, please.

FOSTER ENGINEERING Company

109 MONROE STREET, NEWARK, N. J.

At Booth 428 Madison Square Garden—November 30 to December 4, 1942.

12-FE-2

Tight Tube Joints

EASILY—QUICKLY—ON FIRST ROLLING

Seldom is it necessary to re-roll a "weeping" joint when Republic ELECTRUNITE Boiler Tubes are used. Joints are tight after one easy, quick roller expanding operation.

And here are the reasons why:

ELECTRUNITE Tubes—because they are cold formed from flat rolled steel and electric resistance welded—are *consistently uniform* in diameter, wall thickness, concentricity and ductility.

They slide easily through holes in tube sheets and drums. The expanding tool rolls the wall evenly and rapidly to a sound joint. Beading over and welding are just as easy and positive.

Are you taking advantage of the easy-to-install features of ELECTRUNITE in speeding up construction or retubing of vital heat transfer equipment? Users have reported up to 30% savings in installation cost. That also means savings in time.

Write us for the complete story. And if you expect the need of tubes in the near future, give us or your nearest ELECTRUNITE Distributor full information on your requirements at the earliest possible date. That will save time, too.

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ELECTRUNITE

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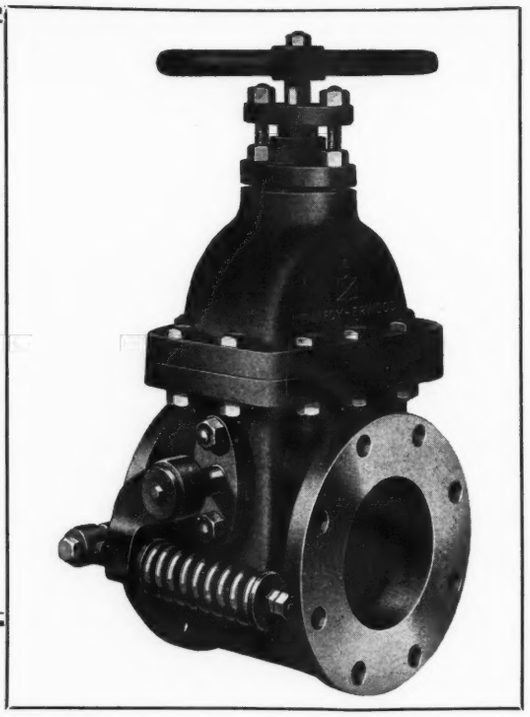
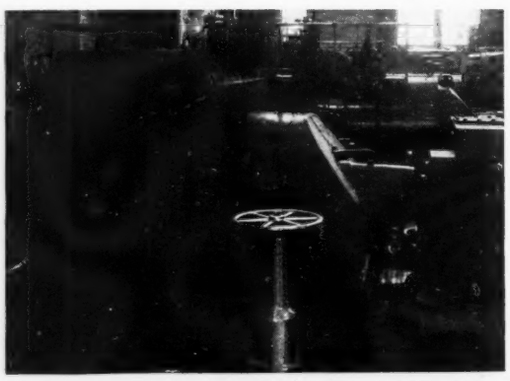
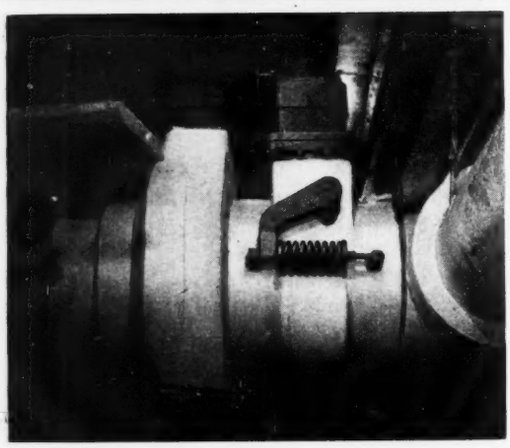
REPUBLIC STEEL PRODUCTION FOR VICTORY

ELECTRIC RESISTANCE WELDED BOILER, CONDENSER AND HEAT EXCHANGER TUBES

Protect Low Pressure Apparatus from Excessive Pressures *with the* . . . . . KENNEDY-ERWOOD *Safety* Swing Gate Valve







Typical installation of the Kennedy-Erwood Swing Gate Valve on the exhaust line between turbine and condenser. An extended stem with floor stand in the turbine room permits convenient hand-operation, and the spring may be set for automatic relief at any predetermined pressure.

This unique design combines the functions of a gate valve, check valve, and relief valve in a single unit. It may be hand-operated as a standard gate valve, and when closed, its adjustable spring-controlled disc will automatically relieve excessive unbalanced pressure in any apparatus or pipe line.

For example, used as a non-return valve on the exhaust line between turbines or engines and condensers or heaters, the Kennedy-Erwood valve protects the low-pressure casing against building up of pressure which might cause failure and serious damage to equipment or injury to operatives.

Other applications are as a back-pressure valve, atmospheric relief valve, or safety gate valve on pumps, compressors, etc.

Write for full information on this important aid to greater plant safety.

THE KENNEDY VALVE MFG. CO.
ELMIRA, N. Y.

KENNEDY-ERWOOD
***Safety* SWING GATE VALVES**

List YOUR heat insulation requirements here

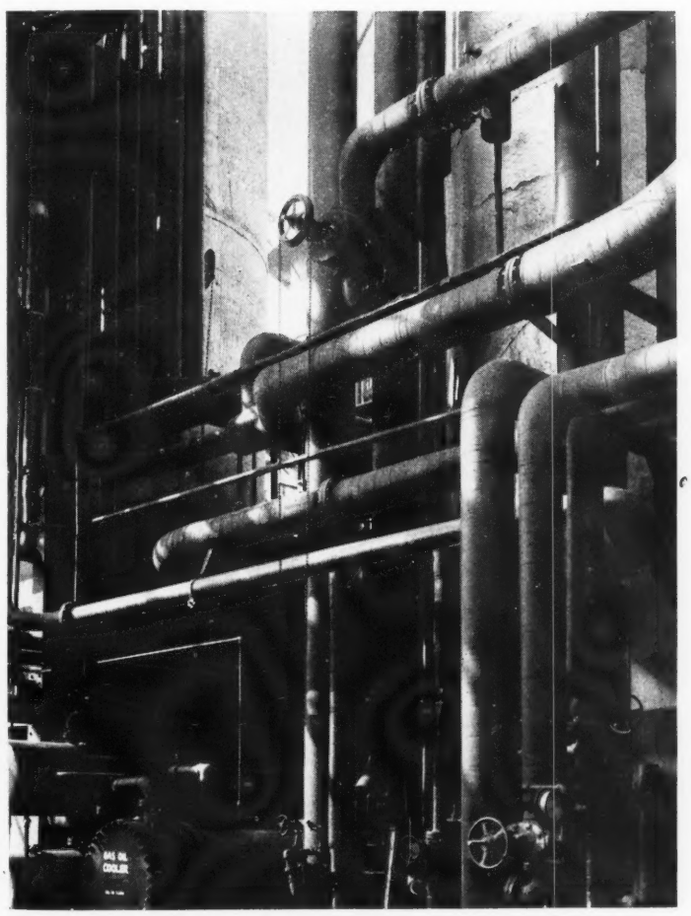
1 _____

2 _____

3 _____

4 _____

—and check them against these unibestos features!



1 HIGH THERMAL EFFICIENCY . . . Unibestos has a permanently low conductivity—has proven on the job, as well as in the laboratory, that it conserves B. T. U.s . . . the vitamins of Industry.

2 STRUCTURAL STRENGTH . . . Unibestos won't soften, shatter or shakedown, even under the most severe conditions—is not affected by vibration.

3 EASE OF APPLICATION . . . Unibestos is the sectional pipe covering—available in sectional form up to 30″ I.D. and over 30″ up to 60″ in quadrants ¾″ to 5″ thickness. In sheet form Unibestos is available in sizes from 36″ x 6″ to 36″ x 36″ and from 1″ to 5″ thickness.

4 WIDE TEMPERATURE RANGE . . . Unibestos is available in either Standard (750° limit) or Super (1200° limit) material or any combination of the two for intermediate temperatures—in single layer construction and with provision for expansion, wherever that is required.

THE ARMY-NAVY "E" AWARDED TO THE PATERSON, N. J. PLANT FOR EXCELLENCE IN WAR PRODUCTION

UNARCO

UNION ASBESTOS & RUBBER CO.

GENERAL OFFICES: 1821 SOUTH 54TH AVENUE, CICERO, ILLINOIS • NEW YORK • SAN FRANCISCO • PATERSON, N. J.

WHAT'S IN A NAME?

CRYSTOLON — The Norton trade mark *For SILICON CARBIDE

CRYSTOLON Products — Manufactured for 32 years

CRYSTOLON — Known to the trade since 1911

CRYSTOLON — An electric furnace product

CRYSTOLON — SiC at its best

*Reg. U. S. Pat. Off.

WHAT'S IN A BRICK?

CRYSTOLON BRICK resist high temperatures

CRYSTOLON BRICK are not affected by abrasion

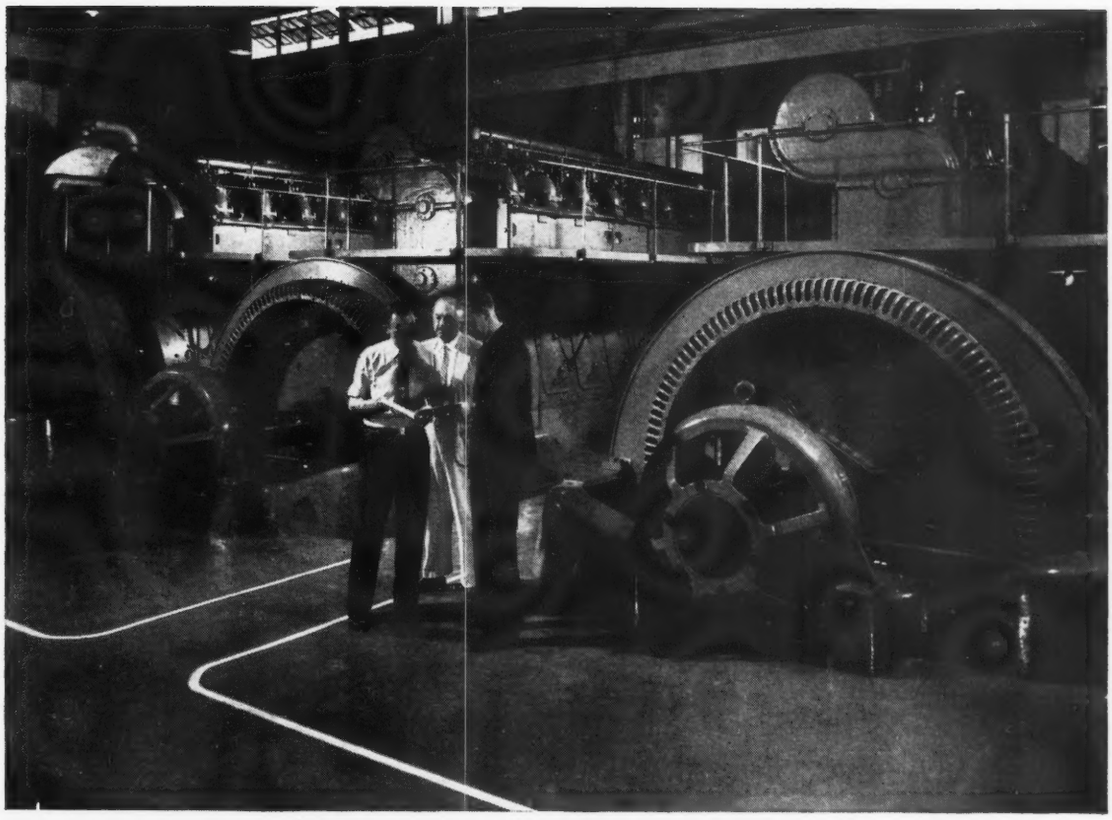
CRYSTOLON BRICK are chemically resistant to stagnation

CRYSTOLON BRICK strongly resist all clinker adhesion

CRYSTOLON BRICK are ideally suited for oil to coal conversion

NORTON COMPANY — Worcester, Mass.

NORTON ELECTRIC FURNACE FUSED REFRACTORIES



After 12,000 hours operation with Gulf Quality Diesel Lubricating Oil:

✓ Negligible bearing and cylinder wear.

✓ Rings, pistons and valves in almost perfect condition.

ANOTHER example of better lubrication with Gulf Diesel lubricating oil! A recent check-up of these three Gulf lubricated 1000 hp. Winton Diesels after 12,000 operating hours showed: (1) Negligible bearing and cylinder wear, (2) Rings, pistons and valves in almost perfect condition. And during this 12,000 hour period, no repairs of any kind were necessary to lubricated parts.

You are sure of better lubrication for your Diesels when you put the proper Gulf lubricating oil in service. For Gulf Diesel lubricating oils not only possess higher lubricating value, but they stand up better under the peak load operating conditions of today—conditions which often cause excessive wear, high maintenance expense and below standard Diesel performance.

For higher operating economy in your plant, take this step today: Call in a Gulf Industrial Lubrication Service Engineer and ask him to recommend the proper type and grade of Gulf Diesel lubricating oil to fit your particular requirements. His thorough training and broad experience with all types of Diesel engines is your assurance of sound recommendations.

Gulf higher quality lubricating oils are quickly available to you through more than 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF OIL CORPORATION
GULF REFINING COMPANY · Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

More than a "Separator"

PROTECTOMOTOR PIPE LINE FILTER DELIVERS *Clean* AS WELL AS *Dry* AIR

Rust, Pipe Scale, Dirt and Dust removed in addition to Water and Oil

Repeat orders from hundreds of leading American concerns prove that Protectomotor Pipe Line Filters save money, speed production. Easy and quick to install. Protectomotors have often saved their entire cost in a single month.

Find out how in your operation Protectomotors will increase output, help win the war.

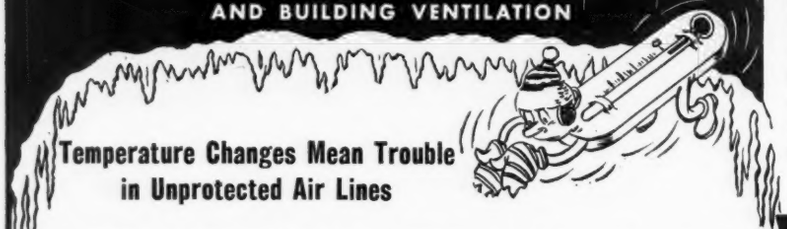
WRITE FOR CATALOG; also Data Form for Free Analysis of your requirements.

STAYNEW FILTER CORP.

23 CENTRE PK. ROCHESTER, NEW YORK

Air Filter Headquarters

FILTERS FOR PIPE LINE, ENGINE INTAKE AND BUILDING VENTILATION



Temperature Changes Mean Trouble in Unprotected Air Lines

Moisture in compressed air is condensed as the air passes through cold sections of pipe. Unless removed, this water washes out lubrication from air-powered tools, freezes upon expansion in these tools, and causes loss of power or stoppage due to clogging of ports; causes delays and waste at other points of compressed air usage. Staynew Pipe Line Filters (Protectomotors), installed as near point of use as possible, remove condensed water and prevent these troubles.

Model CPH

Positive Action★ Exclusive Construction

As air strikes Aluminum Baffle (2) most water, oil and heavier particles are thrown to sides of Container (1), draining to bottom where excess is drawn off thru Drain Cock (5). Passage of all wet or dry matter is positively prevented by exclusive Feltex dry-type filtering medium in patented Radial Fin Insert (4). Only clean, dry air is delivered.

PROTECTOMOTOR AIR FILTERS
99 and 44/100 Per Cent Efficient

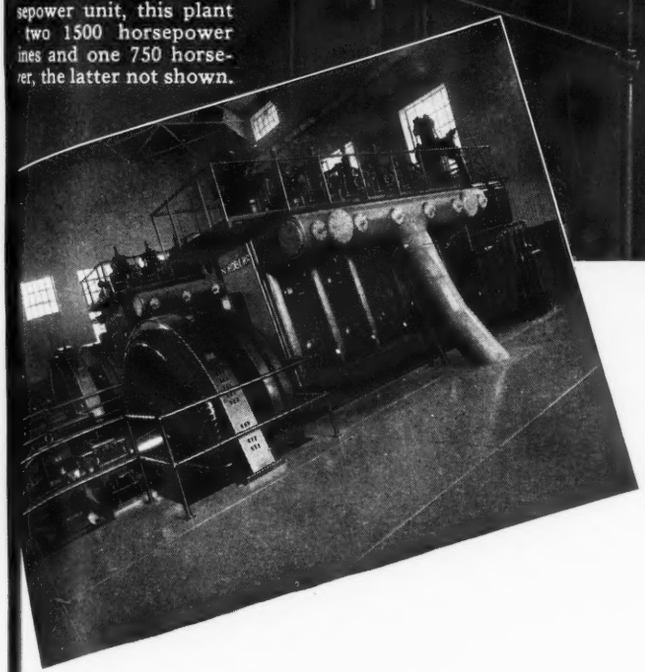
YOU NEED PROTECTOMOTOR MORE THAN EVER IN WINTER

4 UNITS-

A THIRD REPEAT ORDER

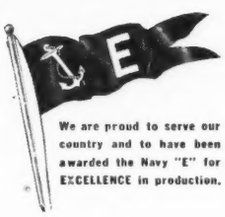
All burn natural gas

ash Company of America
Carlsbad, New Mexico
ddition to this new 2400
sepower unit, this plant
two 1500 horsepower
ines and one 750 horse-
er, the latter not shown.



With the fourth Nordberg Diesel Engine in service at the Carlsbad, New Mexico plant of Potash Company of America, this makes the third repeat order this company has placed with Nordberg in four years. Here is another satisfied Nordberg customer and evidence of the satisfactory performance given by these four engines totalling 6150 horsepower. The first three units were originally arranged to burn fuel oil but have since been changed to burn natural gas. With the Nordberg Dual Fuel Burning Engine it is possible to change quickly from one fuel to the other without change of any major engine parts. Where natural gas is available this engine offers outstanding advantages. It is the most efficient gas burning engine available today. Write for Bulletin 106

NORDBERG MFG. CO. • MILWAUKEE



We are proud to serve our country and to have been awarded the Navy "E" for EXCELLENCE in production.

NORDBERG
DIESEL ENGINES

NORDBERG MACHINERY

The following explains briefly some of the reasons why so many of the war plants have installed Thermix Fan-Stacks instead of an ordinary induced-draft fan and stack.

THERMIX FAN-STACK	ORDINARY FAN WITH STACK
1. Breeching is integral with Thermix Stack—saves steel.	**1.** Connecting breeching required between Fan and chimney —wastes steel.
2. Fan inlet boxes integral with the Thermix Stack — simplifies ducts—saves steel.	**2.** Double inlet fan boxes require more complicated ducts—wastes steel.
3. Diffusing stack converts velocity pressure to static and, by its smaller average diameter, saves steel.	**3.** Cylindrical stack or chimney —wastes steel.
4. Single support is for fan and stack combined—saves steel.	**4.** Separate supports required for fan and stack—wastes steel.
5. Comparatively straight gas flow, reducing power losses to negligible amount.	**5.** Draft losses occur due to changes of direction and section.
6. Unit responsibility for draft by combining all of these parts into one apparatus, guaranteed to produce definite draft at its inlet —and saves steel.	**6.** Design and purchase of three parts — Fan *and* breeching *and* stack — which composes entire draft producers. No unified responsibility for draft.

Cost is reduced over the I.D. Fan — Breeching — Stack arrangement, and the Thermix simplification is better engineering.

Hundreds of power plants — for central power stations, war plants for the Army and Navy and manufacturing plants of all types have been equipped with Thermix Stacks during the past 18 years.

Write for our interesting catalog No. 109.

PRAT-DANIEL CORPORATION, PORT CHESTER, N. Y.

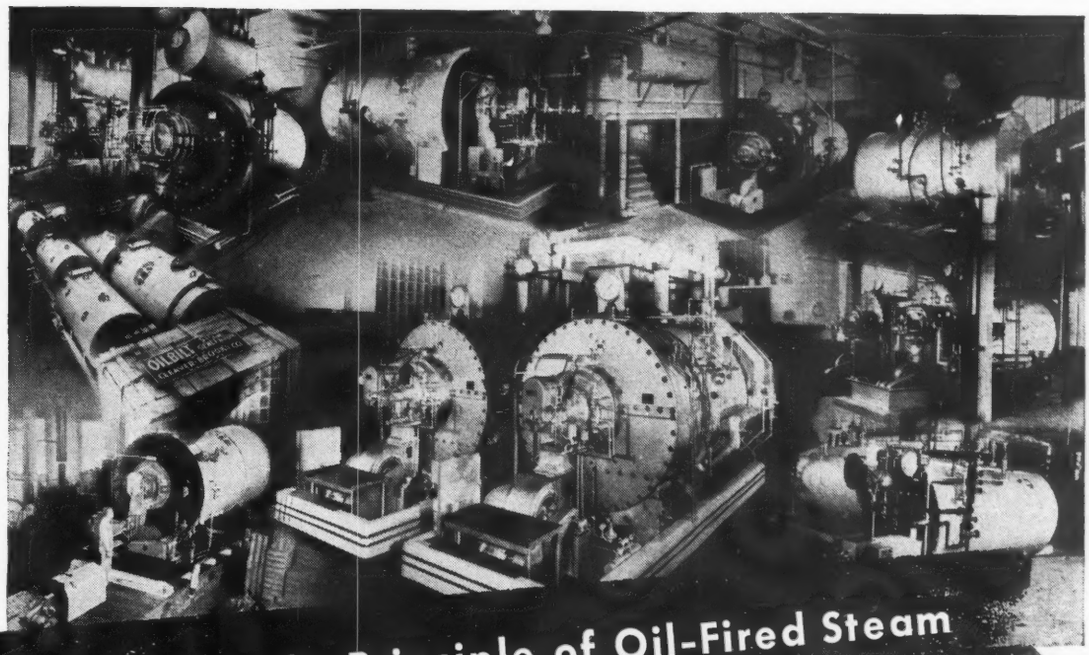
General Sales Agents

Thermix Engineering Co., Greenwich, Conn.

Manufacturers of Thermix Dust Collectors and Induced-Draft Stacks

Representatives in Principal Cities

THERMIX FAN STACK



Reproduction of photo-mural, as shown in the Cleaver-Brooks offices, depicting representative Oilbilt steam plant installations.

The Cleaver-Brooks Principle of Oil-Fired Steam Generation . . . Finds a Vitally Important Application in Equipment for Our Fighting Forces

Reproduction of photo-mural which is a composite illustration of various types of Cleaver-Brooks equipment built for our armed forces.

Known for their efficient application of the multi-pass, down-draft heating principle, Oilbilt steam plants are providing steam for power and processing in hundreds of industrial establishments — helping them to meet record-breaking production schedules for war equipment.

Mobile equipment, employing the same proven principle of firing with America's ideal fuel — *oil* — and including hot water heating equipment, special steam generating plants, portable shower bath units, distilling, sterilizing and disinfecting equipment, is contributing to the safety and comfort of our fighting forces wherever they are located.

Now manufactured for a nation at war, Cleaver-Brooks products will resume their peacetime service when Victory day comes.

CLEAVER-BROOKS COMPANY
5109 North 33rd Street • Milwaukee, Wisconsin

CLEAVER-BROOKS COMPANY • MILWAUKEE, WISCONSIN

Gauging Flow Meter A

Suppose you had the time to set up an ideal specification for a flowmeter. Naturally your first consideration would be accuracy. Here is a standard for gauging meter accuracy. This standard is the ratio of power to friction.

Let's Consider an IDEAL FLOW METER

We would look for 4 POINTS

- HIGH ACCURACY
- LOW MAINTENANCE,
- READABILITY, and
- ADAPTABILITY TO VARYING CONDITIONS

1. Accuracy is the No. 1 consideration.

MOST METERS MEASURE FLOW THRU THE VELOCITY HEAD

Produced by

ACCURACY DEPENDS ON HOW WELL THIS U HEAD IS TRANSLATED TO THE

, *and*

2. Accuracy depends on what's between the orifice and the chart.

IN ALL METERS...

FRICTION MUST BE OVERCOME

POWER MUST BE DELIVERED TO PEN

HIGH ACCURACY = $\frac{\text{POWER}}{\text{FRICTION}}$

3. Here then is the basic standard . . . $\frac{\text{POWER}}{\text{Friction}}$

The COCHRANE METER

... Approaches This Ideal

Lets See How!

7. Well, let's see how we do it.

COCHRANE *Friction Free* FLOW METER

STARTS with a FRICTIONLESS TRANSMITTER

FRICTIONLESS FLOAT IS PILOT FOR

% FLOW

ENDS with HIGH and EQUAL POWER AT PEN THRUOUT SCALE

8. Exactly as the ideal requires, the motor supplies high power from 0-100% . . .

COCHRANE *Friction Free* FLOW METER

Gets its accuracy from BASIC DESIGN

MEASURING CIRCUIT RELIEVED OF ALL WORK

FRICTION FREE Transmitter

SENSITIVE DETECTOR (Galvanometer)

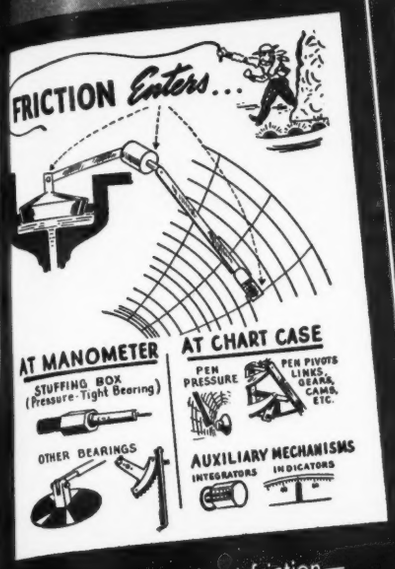
POWERFUL Balancing & Recording Mechanism

In Accordance with The NULL Method

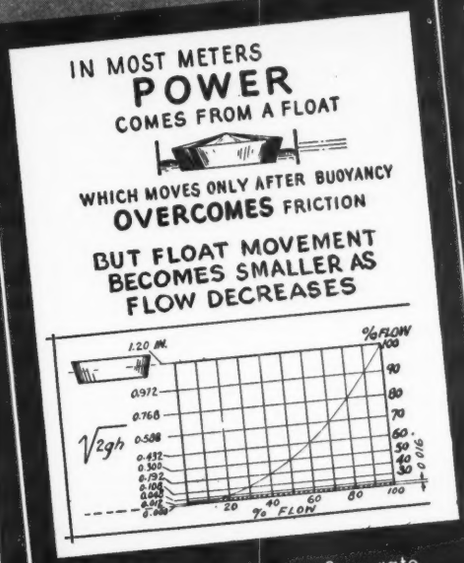
UNIVERSALLY RECOGNIZED AS THE IDEAL METHOD OF PRECISION MEASUREMENT

9. because in this NULL system the circuit does no work.

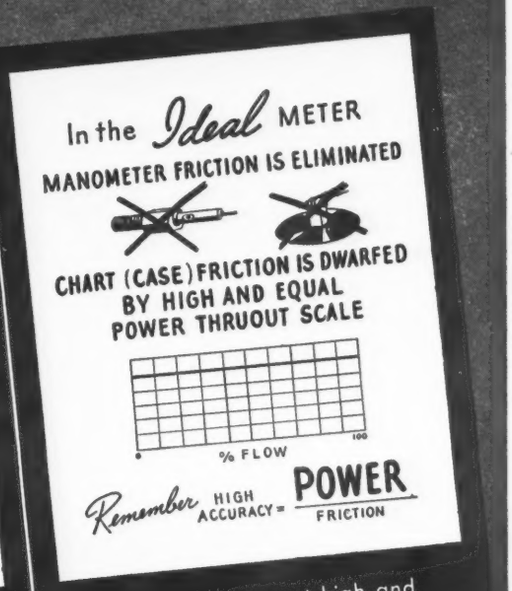
Accuracy



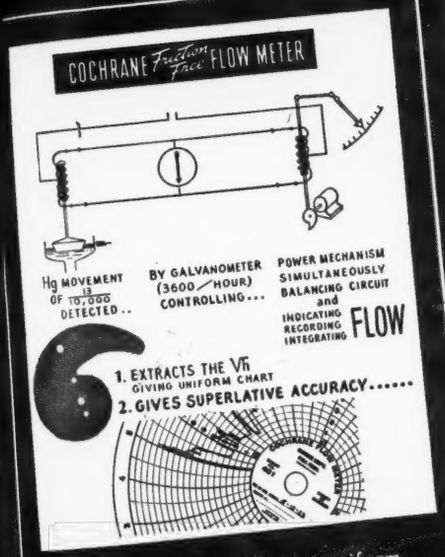
4. No meter is without friction—and some have considerable.



5. And the lower the flow rate the smaller the power ($\sqrt{2gh}$)


In the Ideal METER
MANOMETER FRICTION IS ELIMINATED
CHART (CASE) FRICTION IS DWARFED BY HIGH AND EQUAL POWER THRUOUT SCALE
% FLOW
Remember HIGH ACCURACY = POWER / FRICTION

6. Note well we want high and equal power from 0 to 100% flow.


COCHRANE Friction Free FLOW METER
Hg MOVEMENT OF 1/10,000 DETECTED..
BY GALVANOMETER (3600/HOUR) CONTROLLING...
POWER MECHANISM SIMULTANEOUSLY BALANCING CIRCUIT and INDICATING RECORDING INTEGRATING FLOW
1. EXTRACTS THE √h GIVING UNIFORM CHART
2. GIVES SUPERLATIVE ACCURACY.....

10. The cam produces a uniform chart AND superlative accuracy because . . .

AND AS VISIBLE PROOF
EACH Cam Shaped to exactly record water column differential thruout scale
Note: ENTIRE Absence of Friction Lag 10 to 100%

11. each cam is INDIVIDUALLY calibrated at 10 test points as shown by the final record chart.

12. Ask us to tell you the complete story covering also Maintenance, Readability, and Adaptability.

COCHRANE

3106 N. 17th STREET PHILADELPHIA, PA.

You can't keep production UP when your boilers are DOWN!

★ All-out war demands all-out production. Delays can be disastrous. Scale and corrosion are worse than a "slow-down" strike and when boilers are down for cleaning, production schedules are knocked flat.

Graver Water Conditioning Equipment is eliminating these delays in thousands of plants all over the country — delivering properly conditioned water so that scale and corrosion *will not form.*

Today such things are measured in terms of man-hours conserved—supplies and munitions produced — lives saved. But, looking ahead to the days of peace, they will eventually be measured in extra dollars earned.

Graver has been designing and manufacturing water conditioning equipment of all types for more than thirty years. This valuable experience, plus the most modern manufacturing facilities, are available for the final solution of your water conditioning problems, whatever they may be. Consult Graver. Take the step — today — that will insure uninterrupted boiler service for years to come. There's no obligation.

See our exhibit at the National Exposition of Power and Mechanical Engineering, Madison Square Garden, New York, November 30th to December 4th, Booth 420

42-54-W

SPEED

WITHOUT SACRIFICING WORKMANSHIP . . .

. . . IN PIPING FABRICATION

TIME is America's most precious commodity. Every hour, day and month saved in the construction of additional power generating facilities means just that much more material produced to beat the enemy.

For nearly 40 years Pittsburgh Piping has been in business to *save time* in fabricating and erecting power and process piping. The systematized pre-fabrication of large assemblies under controlled shop conditions makes possible faster construction schedules and also produces better, more accurate workmanship than is possible in the field.

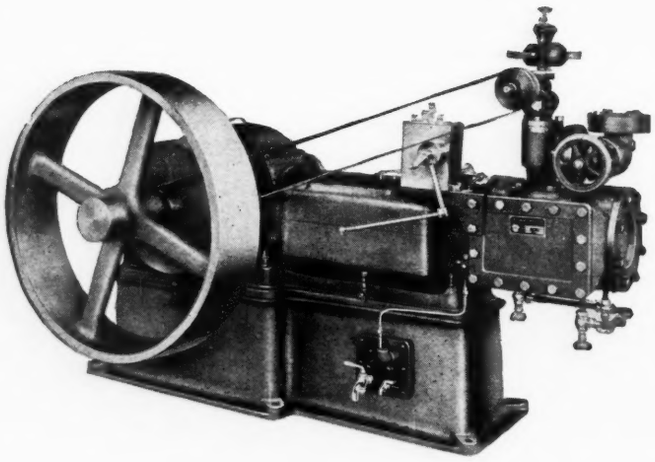
Now with time at a premium, Pittsburgh Piping is ready to save months on the construction of piping systems, without resorting to any shortcuts which might adversely affect the quality.

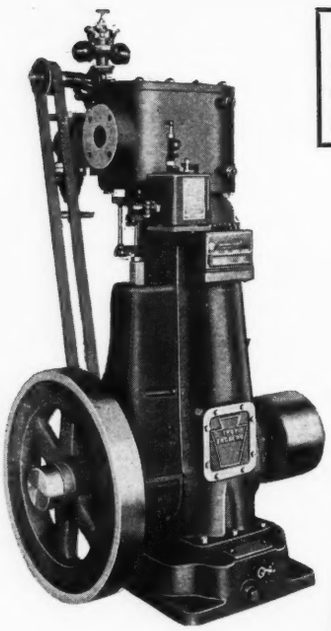
PITTSBURGH PIPING & EQUIPMENT CO., 10 FORTY-THIRD ST., PITTSBURGH, PA.

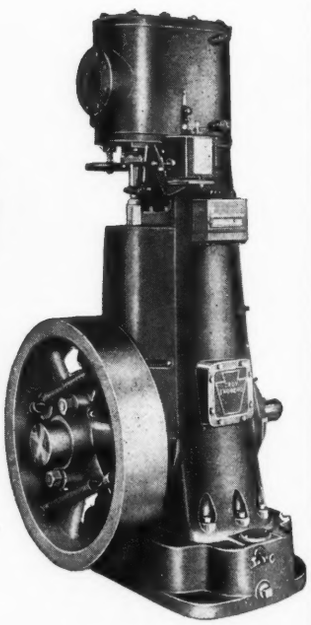
Woolworth Building, New York — Occidental Building, Indianapolis — Peoples Gas Building, Chicago — Union Guardian Building, Detroit
Public Square Building, Cleveland — 10 High Street, Boston — 525 Market Street, San Francisco

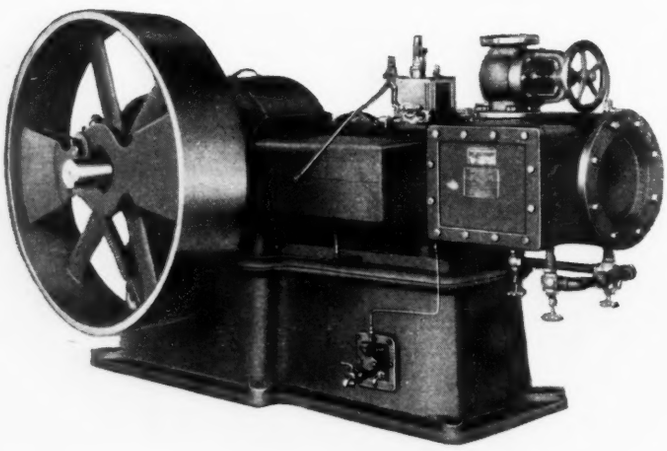
TROY-ENGBERG

Often THE BEST DRIVE *and* ALWAYS









Troy-Engberg is cooperating 100% in the government's 10% Bond payroll deduction plan

TROY

STEAM ENGINE

Industry has thousands of Troy-Engberg Steam Engines in service today driving pumps, compressors, exhausters, fans, blowers, stokers, generators and other power plant or process plant equipment. Hundreds have been purchased during the past year or two by the Maritime Commission in the form of generator sets for producing direct current aboard the Liberty Ships.

Reasons for selecting the steam engine over other types of drives will vary according to application and condition. In some cases—driving those DC generators, for example—it is because of the steam engine's low maintained steam rate. For driving pumps in refineries, it is the unquestioned dependability with quick starting and high starting torque running a close second. With stokers, it is the engine's flexibility and wide speed range.

No other drive can top the Troy-Engberg Steam Engine in its dependability. Where conditions are right, none can match its economy. And with its dependability and economy go several useful drive characteristics.

To get acquainted with this modern steam engine, send for Bulletin 101 which tells the story of its economy. Then consider its use in your plant not only as the drive for strategically used new equipment but as the replacement for drives now in service that may be wearing out.

TROY ENGINE & MACHINE CO.

1482 Railroad Ave., Troy, Pa.

ESTABLISHED 1870

ENGBERG STEAM ENGINES • • • GENERATING SETS

12-TEM-2

Pick 'em to Last!

Be it fillies or fittings, endurance counts.

• Avoid future procurement troubles by installing W-S High-Pressure, High-Temperature Fittings now—even where pressures and temperatures are only moderate. These fittings will last far longer in any installation — through future months when all fittings may be more difficult to obtain. Service records prove their long life outweighs the additional cost.

Check the facts yourself, in free Bulletin A-3. It presents full information on the wide available range of sizes and pressure ratings in both welding and screw-end types. Order through your regular Mill Supply Distributor.

THE WATSON-STILLMAN CO.

ROSELLE, NEW JERSEY

Engineers and Manufacturers of Forged Steel Fittings and Valves, Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks

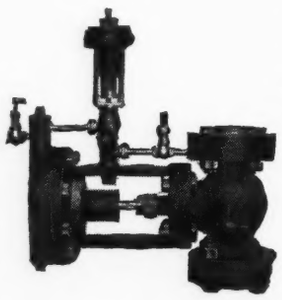
W S

Look for the double-diamond trade-mark

2521

Squires CLASS E PUMP GOVERNOR

Is simple in construction and fulfils all conditions required of a pump governor. Real service is expected from every cash outlay for mechanical equipment, and Squires Steam Specialties are a receipt in full for such investments. It's worth your while to inquire about them.



Squires
Class E
Pump
Governor

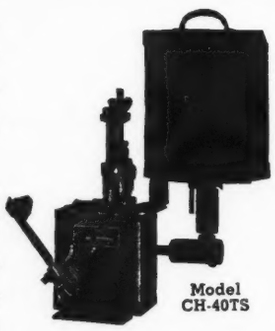
Described in Catalogue A-11. Sent upon request

The C. E. Squires Company

East 40th St. and Kelley Ave., Cleveland, Ohio

MANZEL-EQUIPPED BOILERS MAINTAIN TOP EFFICIENCY LONGER

Manzel Chemical Feeders never forget—they inject the desired amount of boiler compound on every pump stroke.



Model CH-40TS

Installed on the boiler feed pump and controlled by it, Manzels inject the boiler compound in exact proportion to the amount of water entering the boiler.

Feed on a Manzel is very accurate and easily adjusted.

Drive mechanism is enclosed in oil-tight case. Only the pumping unit comes in contact with the chemical.

Write for Bulletin

MANZEL BROTHERS COMPANY

326 Babcock St. **Buffalo, N. Y.**

The Secret of Trouble-Free Stoker Performance...

OTHER "F & E" FEATURES

Interval Timer Governor (patented). Permits extremely accurate regulation of coal feeding rates; provides Full-Stroke, Full-Speed Ram Action at all times. *Sliding Bottom Retort.* Assures perfect fuel distribution. *Removable Ram Case Liner.* Reduces maintenance costs. *Ram Safety.* Entire mechanism stops should foreign matter be fed in with coal. *Exterior Fuel Bed Regulator.* Permits outside adjustment to fuel bed in event of change in quality of fuel.

The power plant is the heart of the stoker. Its design, its proved performance and its ability to "take it" are the factors that control the success of the entire stoker installation. Economy, dependability and maintenance depend upon it!

"F & E" Stokers feature the Electro-Hydraulic Drive . . . the drive that engineers say is the most positive method of power transmission. The entire mechanism has only 5 moving parts . . . sealed and operating in a bath of oil. There are no gears or ratchets to wear out, no pipes, valves or fittings to break. It is amply protected against breakdowns.

No wonder "F & E" Underfeed Stokers enjoy an enviable performance record in many hundreds of power plants in every field of industry.

F&E STOKERS

FOR INDUSTRIAL AND COMMERCIAL BOILERS REQUIRING FROM 1,000 TO 40,000 LBS. OF STEAM PER HOUR

Manufactured by

FLYNN & EMRICH COMPANY

Established 1842

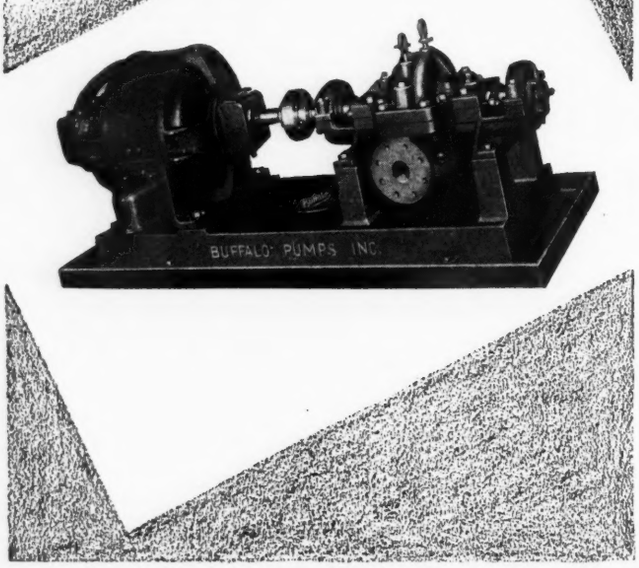
BALTIMORE • MARYLAND

REPRESENTATIVES IN PRINCIPAL CITIES

★

Backing Up The

POWER OFFENSIVE



It's no longer "power for defense"—now is the time for offensive action. And Buffalo Pumps are equal to the task of meeting Industry's call for *more* and *more* power. Buffalo *Boiler Feed* Pumps refuse to give up, regardless of exacting demands. Their in-built quality and ruggedness . . . their smooth, vibration-free operation . . . their high efficiency makes them faithful allies in today's "Battle of Production".

BUFFALO PUMPS INC.

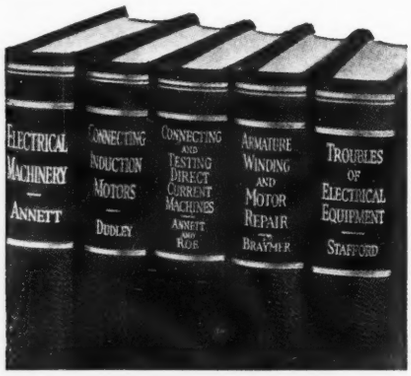
488 Broadway, Buffalo, N. Y.

Branch Engineering Offices in Principal Cities
Canada Pumps, Ltd., Kitchener, Ont.

"Buffalo" PUMPS

Every phase of electrical maintenance and repair work covered in this Library

5 volumes of practical how-to-do-it information



Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

5 volumes—2042 pages—1721 illustrations

IN these books will be found answers to practically all the repair and winding problems that the electrician will meet in actual practice. The books discuss direct and alternating current windings—repair shop methods for rewinding armatures—commutator connection—the testing of armature windings—the testing of induction motors for faults—practical way of reconnecting induction motors—commutator repairs—correct brush troubles, etc. They tell you how to inspect and repair motor starters and generators—how to diagnose motor and generator troubles—how to figure new windings for old cores on induction motors. You learn about three-wire systems, starting rheostats, transformers and starting polyphase motors, etc. They give you scores of practical methods used by electrical repairmen to solve special problems.

Includes trouble-shooting and repair book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library of Electrical Maintenance and Repair includes Stafford's *Troubles of Electrical Equipment*, a handy book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library helps you to know the why as well as the how of electrical maintenance and repair work, gives you the ability to handle bigger jobs with surety of results.

10 Days' Examination—Easy Monthly Payments

You can secure the use of these five great books on electrical repair work for *ten days' examination*. When you have seen for yourself what these books are and how much they can help you, send us your first remittance. The balance may be paid in monthly installments of $2.00 until the price of the library is paid. Send for the books today. Fill in and mail the On-approval Coupon.

McGRAW-HILL FREE EXAMINATION COUPON

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Send me the Electrical Maintenance and Repair Library (5 vols.) postpaid for 10 days' examination. Within 10 days of receipt I will send $1.00, and $2.00 monthly until $15.00 is paid, or return the books postpaid.

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HOW TO GET THE MOST FROM YOUR THERMAL INSULATIONS

1 Select the proper material for the temperature involved.

2 Consider the proved ability of the material to sustain efficiency.

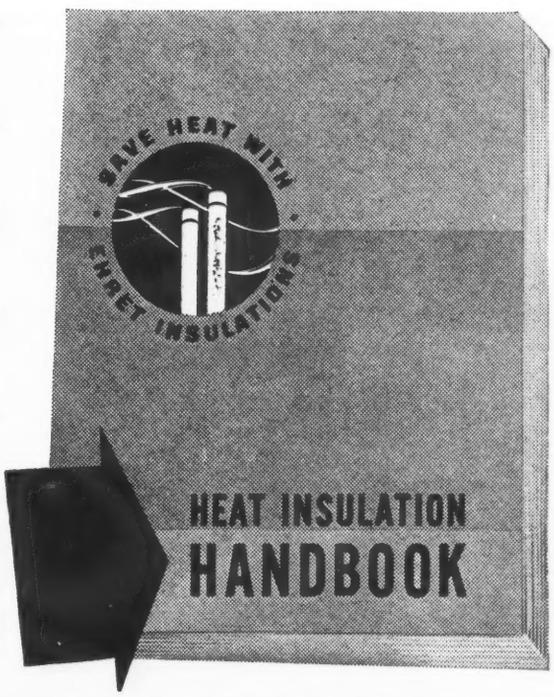
3 Make certain that thicknesses are adequate for full economy.

4 Be sure that application is both skillful and correct.

5 Don't overlook the "small" unprotected surfaces.

6 Inspect and *maintain* your insulations regularly.

7 **Write now for a free copy of the 176-page Ehret Insulation Handbook, No. A 212. It contains answers to practically all the problems involved in selecting, specifying, applying and maintaining insulations on hot and cold piping and equipment.**



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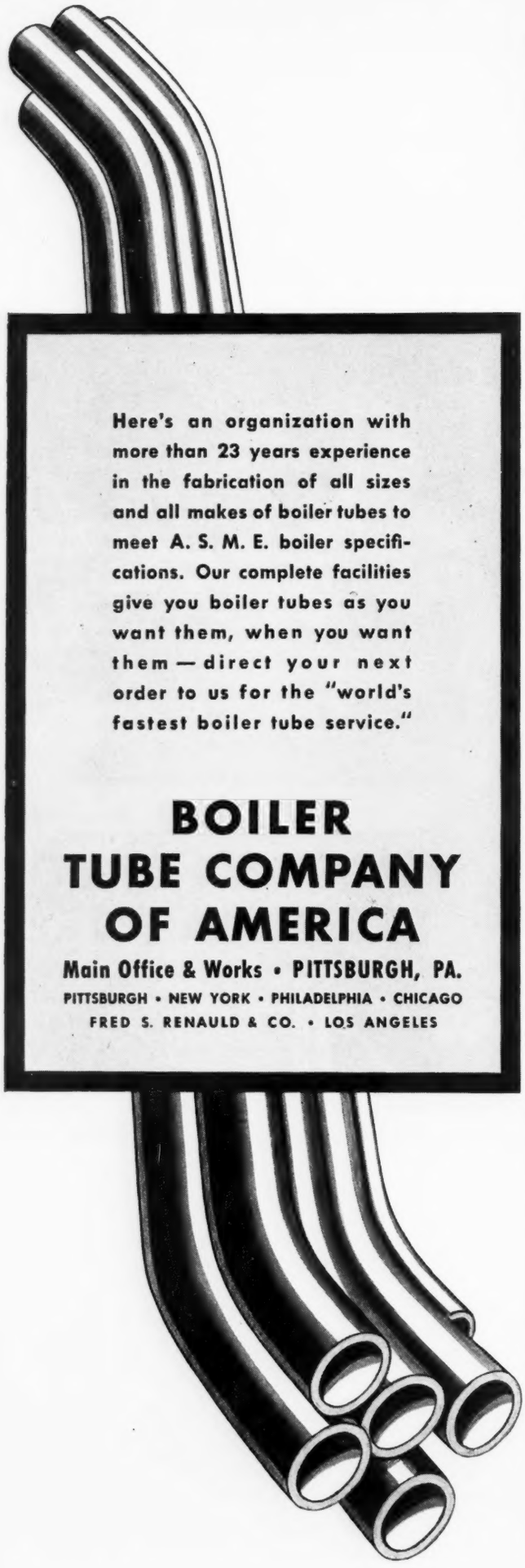
...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA



Here's an organization with more than 23 years experience in the fabrication of all sizes and all makes of boiler tubes to meet A. S. M. E. boiler specifications. Our complete facilities give you boiler tubes as you want them, when you want them — direct your next order to us for the "world's fastest boiler tube service."

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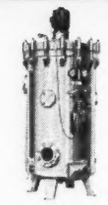
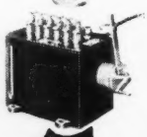
To Keep the wheels **TURNING**

BOWSER

LUBRICATING EQUIPMENT





Lubricating the wheels of industry has been a Bowser specialty for 57 years. Whether you need a single feed lubricator or oiler for one bearing . . . a filter for an engine or turbine . . . an overflow sight or a pressure sight feed oiler . . . a filtering system for cutting oils or coolants . . . or even a huge system for a gigantic steel mill, you will find that it pays to consult Bowser. A staff of trained lubrication engineers is at your service . . . anytime.

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FILTERS
LUBRICATORS
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TURBINE OIL CONDITIONERS
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TO HELP WIN THE WAR OF Production

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LUBRICATING OIL EQUIPMENT SPECIALISTS

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Refer this to your Electrical Maintenance Supervisor

TO PREVENT COSTLY SHUTDOWNS

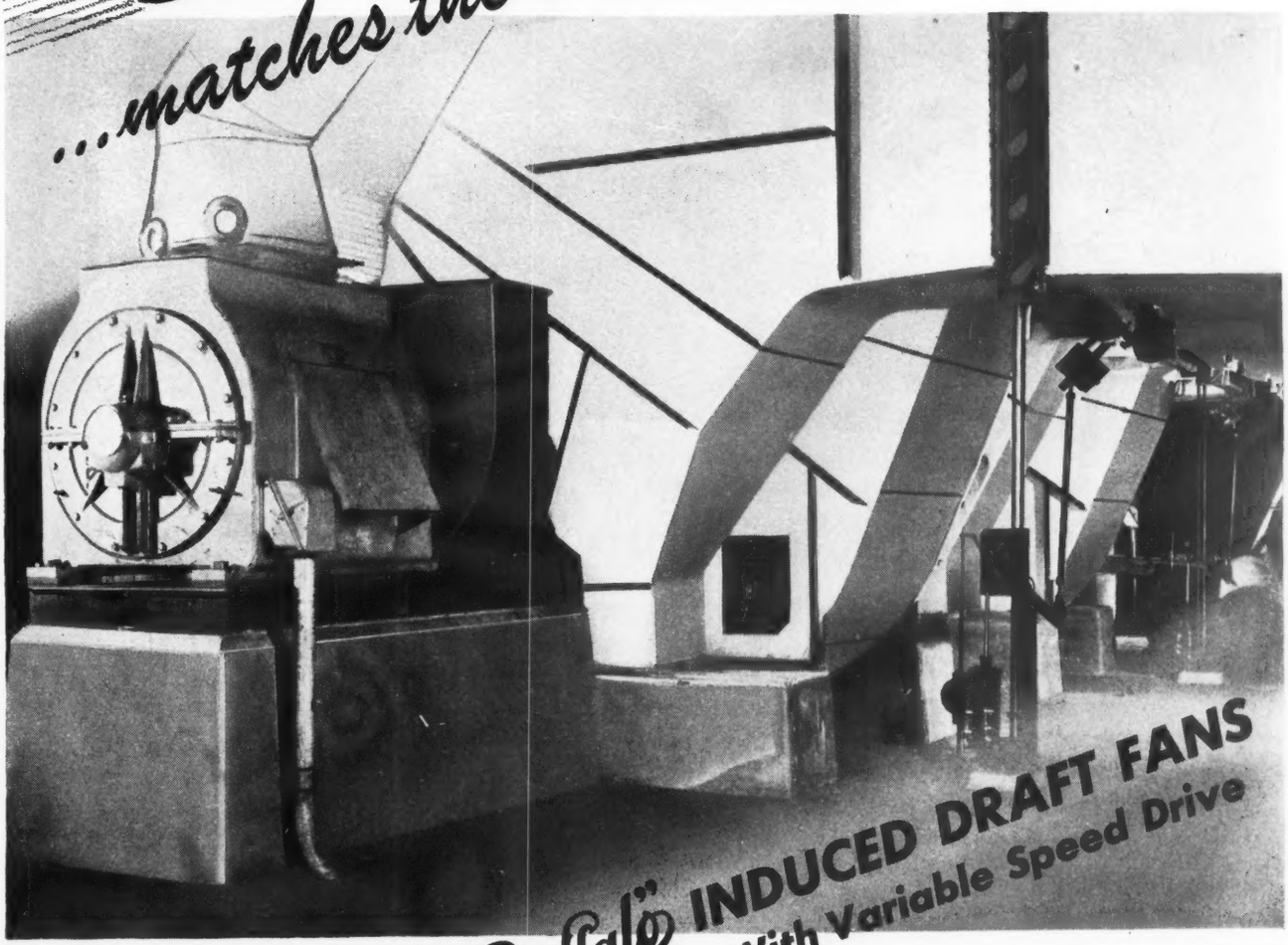
Restore and Maintain Original Efficiency
of Motors WITHOUT DISMANTLING
Use IDEAL Motor Maintenance and Repair Equipment,

Commutator and Slip Ring Resurfacers, Brush Seaters, Commutator Cleaning Stones, Precision Grinders and Mica Undercutters; also Coil Winder's Tools, Electric Soldering Irons, Electric Markers, Electric Cleaners, etc.
Keep Motors and Generators "On The Job" and prevent interruption of production schedules.

Write for your copy of NEW Maintenance Equipment Catalog TODAY

IDEAL COMMUTATOR DRESSER COMPANY
1025 PARK AVENUE SYCAMORE, ILLINOIS
Sales Offices in All Principal Cities

SPEED ...matches the boiler NEED



It's just good logic! Run the fan at the speed necessary to carry boiler ratings and you conserve rotors and housings as well as save power. Experienced station operators agree on this point. Buffalo Induced Draft Fans with variable speed drives provide economical operation in many of the nation's power plants. Buffalo Induced Draft Fan installations provide greater draft efficiency . . . minimize the expense and delays of replacement . . . contribute to more dependable delivery of power for Industry's wartime needs.

BUFFALO FORGE COMPANY

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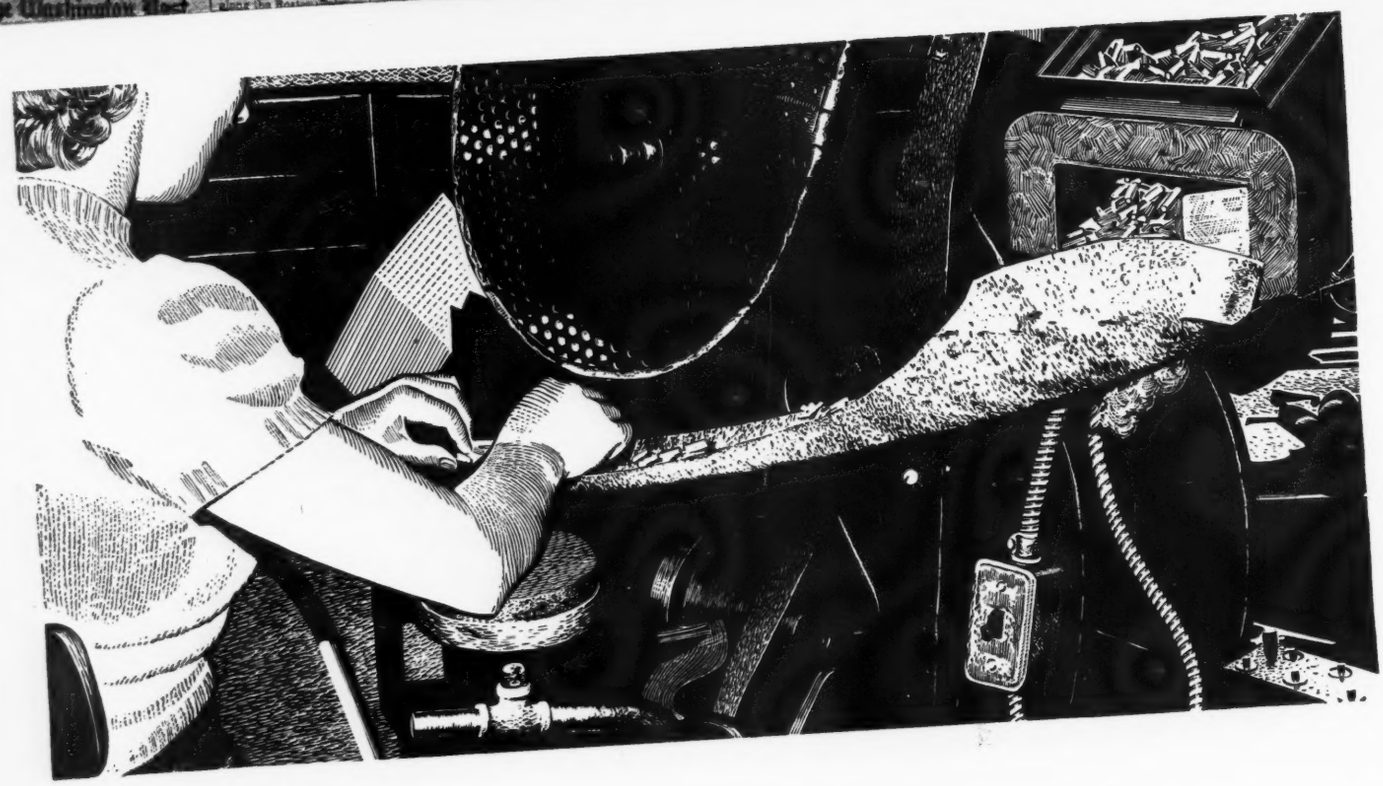
Branch Engineering Offices in Principal Cities
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" MECHANICAL DRAFT FANS



How Sally used up a copper mine

LOOK at the picture carefully. See that elbow-rest under Sally's arm?

It is significant. In fact, it's a humble sermon on war production.

Understand the existence of that arm-rest and you understand one of the basic reasons why, in less than seven months after war-conversion, American industry is hollering for Washington to provide more copper and other basic raw materials.

► Before Sally got her arm-rest, she reached over to a box, picked up a tiny part for an airplane instrument and placed it in the machine . . . Now the supply box is tilted and constantly jiggled, so that the parts flow to her finger-tips. With each motion Sally saves a fraction of an ounce of energy and half a second of time.

Without such tiny savings of time and effort, America's 20,000,000 factory workers would be hopelessly handicapped in their race against the millions at work with a head-start of years in Germany, Japan and Italy.

► The muscle-misers and second-savers of our factories come in handy in this war, when splitting seconds in production is as important as it is in battle.

Who are the men that provide the arm-rests, jiggle the supply-boxes, conduct the ceaseless hunt for wasted half-seconds and needless human motion?

► They are the "methods" men of industry. They have all sorts of titles: plant managers, operations managers, methods engineers, efficiency engineers, etc. But their job is "to manage men and machines to save time and materials."

In peace, these men were the core of the industrial system that gave you the world's highest living standard at the world's lowest cost in hours of work.

► In war, these same "methods-managers," with the intelligent cooperation of American workmen, are cutting years from our arming task by splitting seconds from its millions of individual operations. This example of time-saving is just an indicator of what a plant operating man does. Such men have many other jobs, including the important job of plant maintenance, but "second-splitting" is the field in which they are the envy of the whole world.

The American Production Manager is the product of the American industrial system. Complex, loose-jointed and aimless though our system may seem to the theorist, it meets every challenge, because it is the best system ever devised by man for discovering, developing and rewarding individual initiative.

Reprints of this advertisement are available in handy booklet form.

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET • • NEW YORK

SALLY—

IS UP YOUR ALLEY!

WASHINGTON, and other large city newspapers were used for the advertisement shown opposite, because government and public need to understand the asset which America has in its trained industrial staffs.

Read what we said about "methods management" in the advertisement, then ask yourself the secret of American genius for production economies in men, materials and time.

One big advantage we have in this country is the interchange of know-how between industries. If an instrument maker reduces a fourth-class hand motion to third-class, all other managers of small part assembly can, and do, find out how it was done.

By means of the articles and advertisements in FACTORY,* a plant operations magazine, tens of thousands of plant operating men keep abreast of each new development in equipment and technique.

The magazines of the McGraw-Hill Network of Industrial Communication exist solely for swapping ideas. They are backed by the editors and engineer-correspondents, who gather information wherever it is developed, and funnel it out to the fields where it is needed.

So valuable is this interchange of technical information that many companies are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, just write to Reading Counselor Department, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York.

★ ★ ★

THE McGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents... More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

*Factory Management & Maintenance—*SHOWS HOW TO MANAGE MEN AND MACHINES TO SAVE TIME AND MATERIALS*

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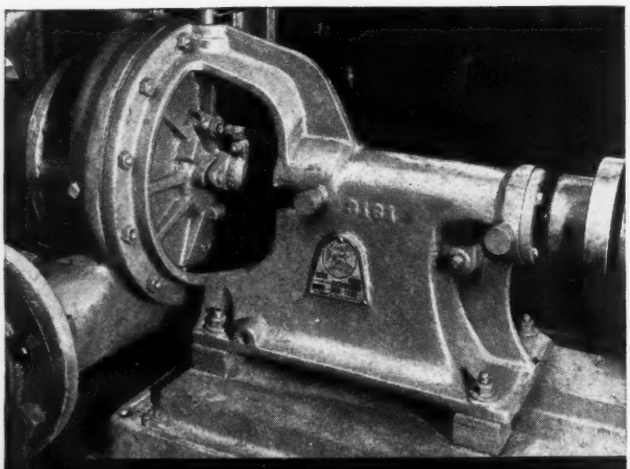
ALSO AFFILIATED WITH BUSINESS PUBLISHERS INTERNATIONAL CORPORATION, PUBLISHERS OF BUSINESS AND TECHNICAL MAGAZINES FOR OVERSEAS CIRCULATION



DEMING PUMPS
ARE IN VITAL SERVICE

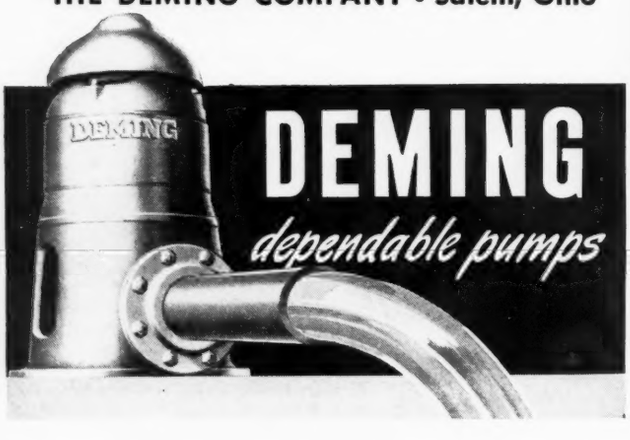
On the Brooklyn Battery Tunnel Job . . . five Deming Pumps are performing vital services. A Deming Centrifugal Pump delivers water to a cooling tower from which another Deming Centrifugal receives the cooled water to discharge it through the water jackets of air compressors and engines which furnish high and low pressure for the tunnel digging operations. (The latter pump is illustrated above.)

Three Deming Turbine Pumps perform the vital service of keeping the water level below the finished line of the tunnel.

Accurate estimating on the part of the Deming representative plus dependable performance of Deming Pumps combined to meet the rigid requirements of this important project.

This is merely a "sample" of the kind of cooperation YOU can obtain on YOUR pumping requirements when you depend on Deming for results.

THE DEMING COMPANY • Salem, Ohio



DEMING
dependable pumps

MAKE SURE YOU KNOW
the important developments and latest procedures in HEAT TRANSMISSION

Out of the vast research and progress made recently in the broad field of heat transmission this new book brings practicing engineers a full, analytical, handy presentation of the most important developments and improved methods. Threefold in its purpose, it analyzes the new data on heat in light of the basic mechanisms by which heat is transferred, presents the recommended relations in the form of equations or graphs, and illustrates the method of attack on new problems.

Revised 2nd Edition

HEAT TRANSMISSION

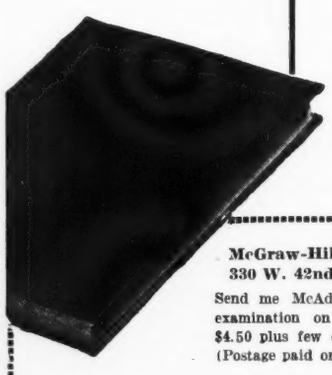
By W. H. McAdams, Professor, Chemical Engineering, Massachusetts Institute of Technology. 459 pages, 6 x 9, 198 illustrations, many tables, $4.50.

Sponsored by the Committee on Heat Transmission, National Research Council, this improved edition is a comprehensive treatise on the various fields of heat transmission, containing authoritative correlations for the various important cases of heat transfer, with numerous examples of the application of the recommended relations.

COVERS:

- Conduction
- Heating and Cooling of Solids
- Radiant Heat Transmission
- Dimensional Analysis
- Flow of Fluids
- Introduction to Heat Transfer between Fluids and Solids
- Heating and Cooling Fluids Inside Tubes
- Heating and Cooling Fluids Outside Tubes
- Condensing Vapors
- Heat Transfer to Boiling Liquids
- Applications of Design

Reliable data from diverse sources, including much unpublished material have been reduced to a common basis for purposes of comparison and have been correlated in the light of the most helpful theoretical analyses. The results of these critical studies are presented as formulas and graphs carefully constructed to give weight to all the data and at the same time make the results readily available for use in engineering design.



10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., Inc.,
330 W. 42nd St., N. Y.

Send me McAdams-Heat Transmission for 10 days' examination on approval. In 10 days I will send $4.50 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

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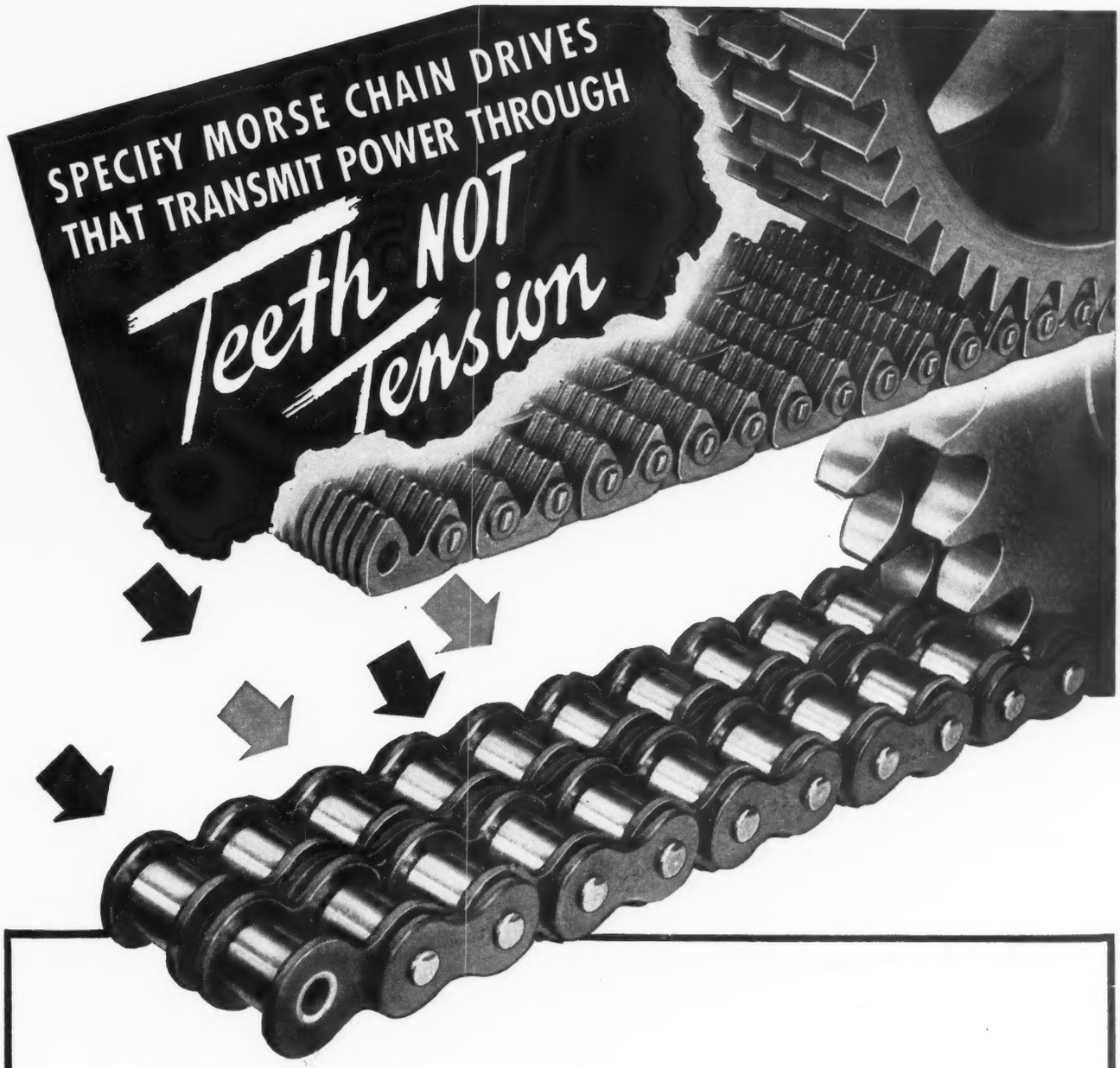

POWER transmitted along slipping, inefficient drives rapidly becomes wasteful —causes undue expense and decreases machine capacity.

With the Morse Chain Drive principle—"Teeth Not Tension"—there is no chance for slip or power waste. All the power is turned into productive war action at practically 100% efficiency. Every Morse Drive is a completely engineered power transmission unit so selected and designed as to render unfailing service in the severest of conditions. There is no need for constant adjustment, inspection—Morse Drives operate for years requiring hardly any maintenance. To keep war production at maximum, specify Morse Chain Drives—your local Morse Drive Engineer will assist you.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

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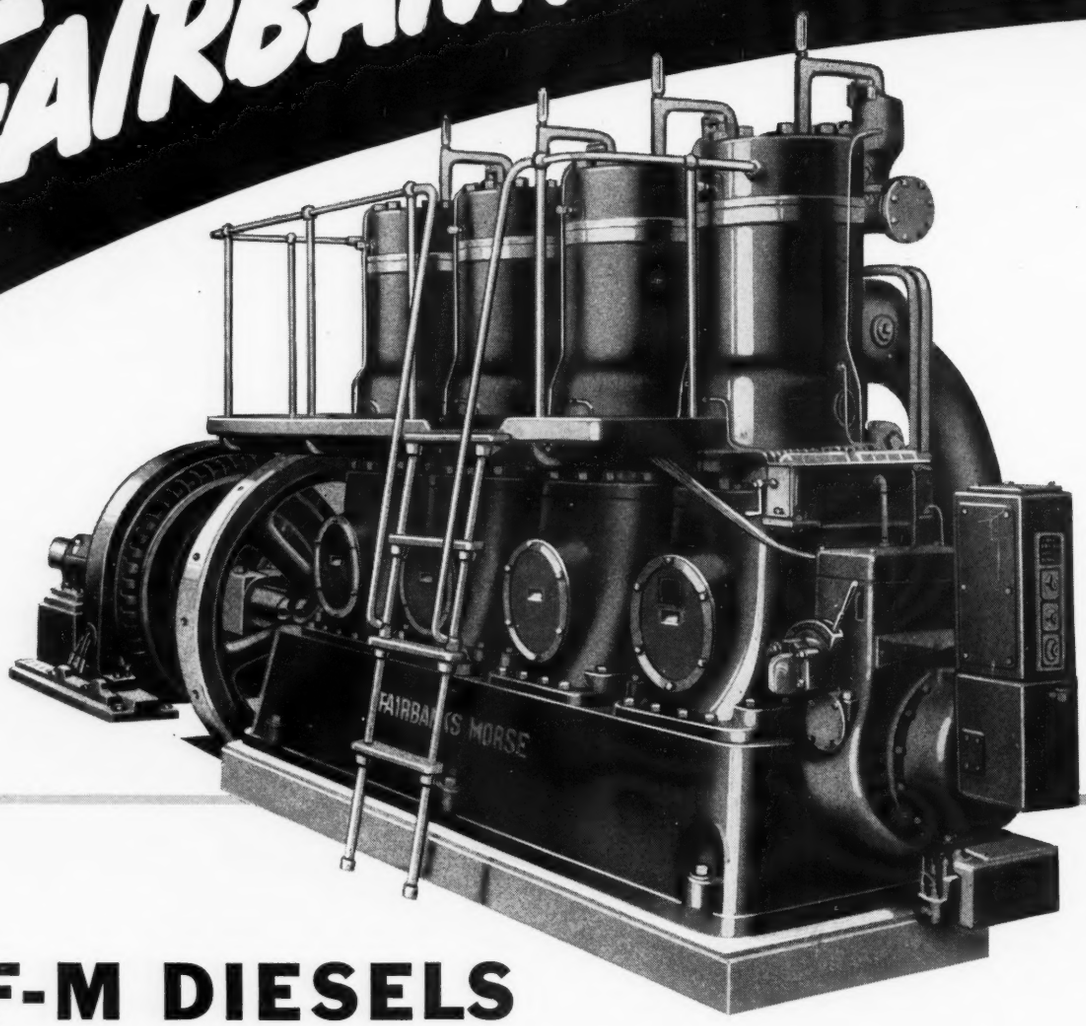


F-M DIESELS

minimize maintenance in heavy-duty service . . .

Simple, 2-cycle principle . . . fewer moving parts to wear and minimum wear on those few because of slower operating speeds. That is the simple way of explaining one of the major reasons why Fairbanks-Morse Diesels have an enviable record for sustained performance and less time out for maintenance. When service does become necessary, it is easier and takes less time.

Other F-M Diesel benefits are: no peak penalties—no demand charges; dependable stand-by service at low cost; off-standard types of current that certain equipment needs without cost penalty.

FAIRBANKS-MORSE

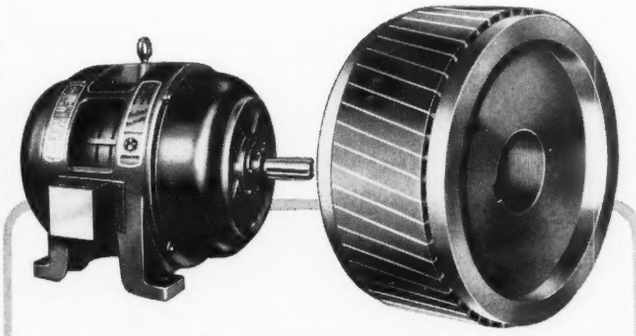
EQUIPMENT . . .

for PERFORMANCE That Keeps PRODUCTION Machinery Going "Full Speed Ahead"

Performance is what you want from equipment these days—performance that requires the minimum of time out for maintenance and repairs . . . performance that eliminates delays on the production line.

The record of Fairbanks-Morse equipment for giving dependable, uninterrupted performance under peak loads of war production is not a new chapter in its history. It is and always has been built to take extra-heavy demands in its stride. Precision engineering, inspection that takes nothing for granted, and rigidly high standards in every step of manufacture from raw material to finished product are the reasons why it can and does minimize maintenance.

Use your priority to get from Fairbanks-Morse the Diesels, motors, and pumps that have the stamina to "stay in there and pitch" during these hectic days of war production when every machine must be kept operating at its peak . . . no stoppage . . . no breakdown . . . no letdown. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Illinois.



DON'T BUY BIGGER MOTORS THAN YOU NEED

Load the F-M Motor with its exclusive COPPER-SPUN Rotor to full capacity; it can take it!

A bigger motor than required by the machine it runs is no longer necessary — or wise. Put Fairbanks-Morse Motors on the job—buy the horsepower needed—but no more. Because of their centrifugally cast, one-piece rotors of COPPER, Fairbanks-Morse Motors can be run under full load indefinitely without fear of overloading—without "down time" for repairs. No other motor has a centrifugally cast rotor winding of COPPER.

F-M PUMPS SAVE POWER

Ten-year-old pumps of certain types, *even if as good as new,* require 25% more power than today's F-M models. Many 4- and 5-year-old pumps of other types consume so much more power than current models that continued use costs more than replacement.

The continued use of 25% more power than necessary is equivalent to shutting down one generator out of four—all of the time! No business can afford that these days!

Diesels • Motors • Pumps • SCALES

KEEP 'EM "METERING"...

IMPORTANT POINTS
to get longer life, best service from
FOXBORO
FLOW METERS
Keep in Mind The Following Points
Check These Points Now
IF IN DOUBT, CALL A FOXBORO ENGINEER
THE FOXBORO COMPANY - FOXBORO, MASS., U. S. A.

with this Quick-Check System!

Meters are but one of many industrial instruments that are essential in the war-production of most plants. They're too important nowadays to permit any risk of interruptions or inaccuracies in their operation. Yet, all it takes to get proof-positive assurance against needless instrument shut-downs is a simple maintenance routine.

To help you set this up, Foxboro now offers a complete Quick-Check System of convenient cards containing A-B-C instructions for every major instrument in your plant. There are individual 9"x11" cards for meters, thermometers, gauges, pyrometers and controllers of various types. Attached to your installations or handily filed, they enable even new-trained instrument men to keep your instruments operating at top efficiency for the duration!

Foxboro Quick-Check Cards are available without charge, to any user of industrial instruments. Although designed specifically for Foxboro Instruments, they serve equally well for other standard instruments. They cover major servicing points important to all makes.

Write for Foxboro Quick-Check Maintenance Cards for your plant, specifying all the different types of instruments you use. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U. S. A.** Branches in principal cities of the United States and Canada.

RECORDING • CONTROLLING • INDICATING

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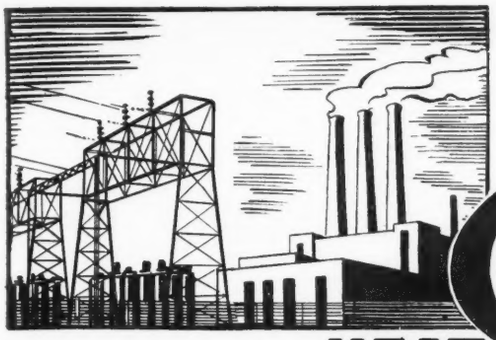


Carey HEAT INSULATIONS

*helping bring the cost of KILOWATTS DOWN

*"In 1917, 3.5 pounds of coal were required to produce a kilowatt hour of electrical energy; in 1940, only 1.4 pounds were required."

*As quoted from report of U.S. Bureau of Mines by Bituminous Coal Research.

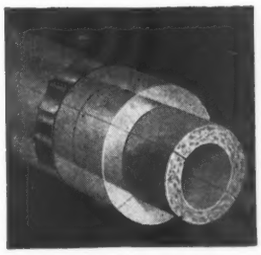
IN effecting this tremendous fuel saving, much credit unquestionably goes to improved engineering. Yet it is equally true that modern heat insulations, by eliminating excessive heat losses, are entitled to share the honors in this notable advance.

In reducing fuel consumption for American industry, CAREY Insulations are rendering outstanding service. It is a matter of record that these high-efficiency products usually pay back their cost in fuel savings in a fraction of a year, thereafter continue to return big annual dividends on the investment.

Carey Insulations and application practices are today so standardized that results, in the form of savings, are readily determined in advance. If you have an insulation problem, let Carey engineers inspect your plant and give an authoritative report. No obligation. For details address Dept. 16.

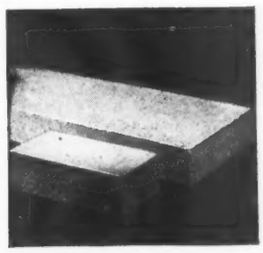
CAREYCEL INSULATION
For Temperatures up to 300° F.

CAREY 85% MAGNESIA
For High and Medium Pressure
200° F. to 550° F.



COMBINATION HI-TEMP 85% MAGNESIA
500° F. to 1200° F.

CAREY HAIR FELT INSULATION
For Sub-Zero Temperatures



CAREY HI-TEMP BLOCKS
For Furnaces, Ovens Kilns, etc.
1000° F. to 2500° F.

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Dependable Products Since 1873
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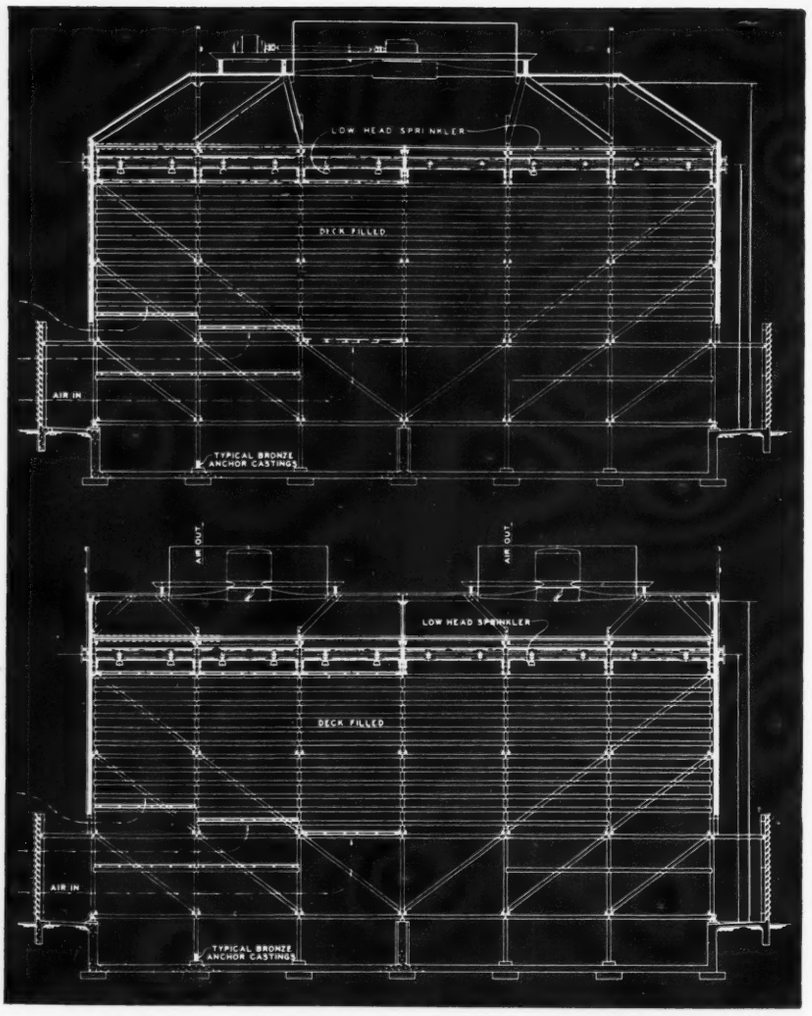

TWO WAYS

to do a Good Water Cooling Job!

Pritchard induced draft towers are designed with either one or two fans per cell. Both types can be furnished with the ordinary right angle drive or with the celebrated Pritchard direct connected gear reducer and moisture-proof, ventilated motor housing.

The single fan type usually is more economical to operate when steam turbine power is to be used. Right angle drives and equipment are more readily obtainable under present conditions.

Costs can be figured for you both ways. Pritchard "featherweight", non-corrosive monel fans are standard equipment in either case.

J. F. PRITCHARD and COMPANY, Fidelity Building, Kansas City, Mo.
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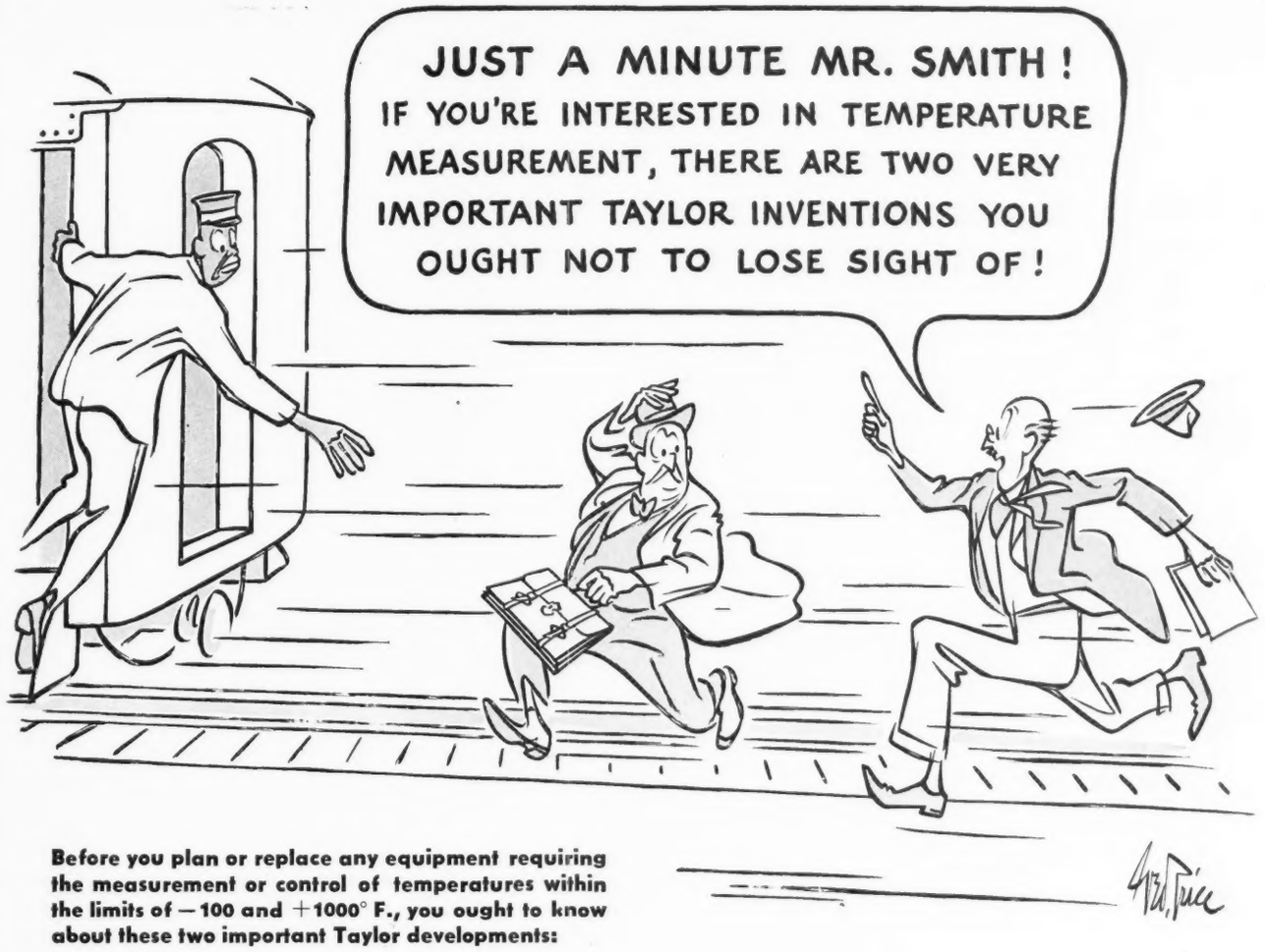
PRITCHARD

Atmospheric and Mechanical Draft

WATER COOLING TOWERS


JUST A MINUTE MR. SMITH!
IF YOU'RE INTERESTED IN TEMPERATURE MEASUREMENT, THERE ARE TWO VERY IMPORTANT TAYLOR INVENTIONS YOU OUGHT NOT TO LOSE SIGHT OF!

Before you plan or replace any equipment requiring the measurement or control of temperatures within the limits of −100 and +1000° F., you ought to know about these two important Taylor developments:

1. Mercury tubing that can't tell a lie! Imagine being able to have all the advantages of a mercury-actuated recording thermometer—on an application requiring long lengths of connecting tubing! It's long been an established fact with Taylor Accuratus Tubing. This precision-bore tubing, a Taylor invention, has a special alloy wire inside, with a coefficient of expansion so related to the tubing and the mercury that any variations in ambient temperatures along the way are counteracted on the spot. The result is *accurate* temperature recordings.

2. Accurate temperatures several times faster! Where a separable well is required to protect the temperature-sensitive bulb from erosion or corrosion (or to permit removal of the bulb without disturbing the contents of the equipment) there always used to be a considerable time lag in transmitting temperature changes to the bulb. But that was before Taylor "Thermospeed" came along. With Taylor Thermospeed Separable Well construction, response is several times faster than the average separable well tube system, with minimum bulb conduction error.

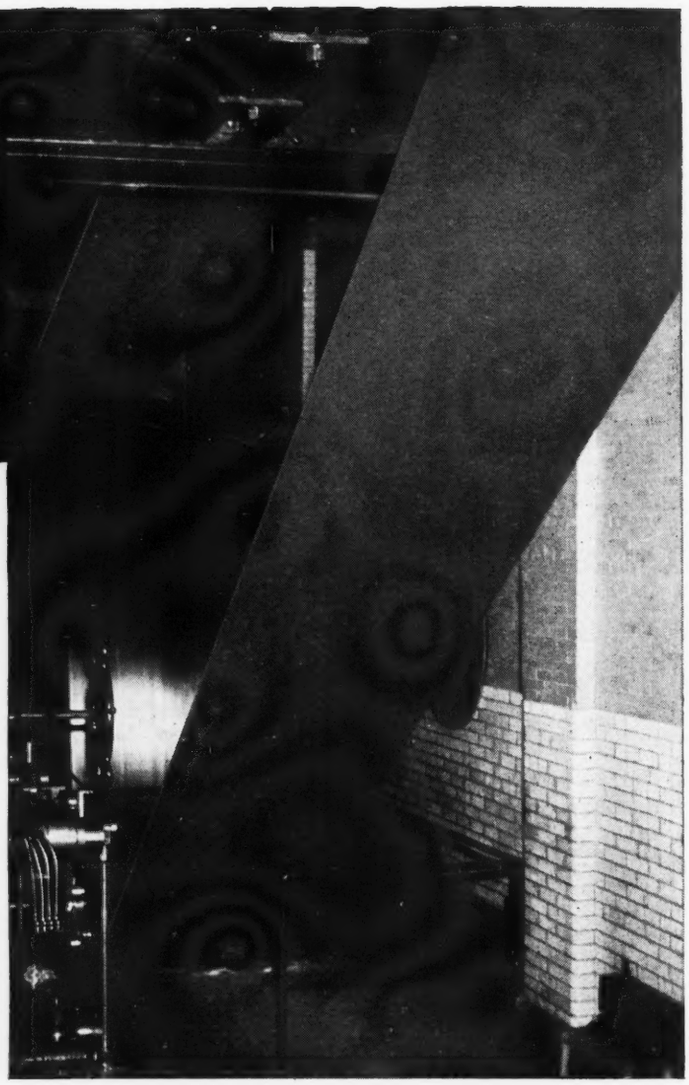
CALL YOUR TAYLOR FIELD ENGINEER. These are only two of the many "plus-values" which have given Taylor its reputation for leadership in the temperature field. If you need indicating, recording or controlling temperature instruments, your Taylor Field Engineer will determine whether a mercury, vapor or gas-actuated system is best for your particular requirements. And from a wide variety of bulb and well constructions and connecting tubings at his command, he will specify the other details which assure the accuracy, responsiveness, and long life characteristic of Taylor Instruments. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, flow, humidity, and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

★ ★ ★ KEEP ON BUYING U. S. WAR SAVINGS BONDS AND STAMPS ★ ★ ★

PLENTY OF ENDURANCE FOR 3 SHIFTS 7 DAYS A WEEK

MAXIMUM PRODUCTION WITH PRACTICALLY NO MAINTENANCE



With little care other than an occasional application of Rhoads' belt dressing, Tannate Leather Belts outpull and outlast ordinary belts . . . Grip tight — run smoothly — keep machines at constant maximum speed, with few letdowns for maintenance — not just for weeks, or months, but for years.

Tannate has high overload capacity. It is stronger than most first-quality oak belting. It resists high temperatures, water, machine oil and many chemicals. And, Tannate is pre-stretched, needs far fewer shutdowns for take-up.

HOW to make a long-lived belt last even longer!

A new folder, "Better Service Belt Hints", tells how best to apply and care for belts. Available, free, for all your men concerned with belting. Write, on your letterhead — mention quantity desired.

Short on machines?

GET MORE PRODUCTION FROM THOSE YOU HAVE

Let Tannate help keep your machines running at top speeds. You'll see production schedules take a turn upward; you'll get more uniform work, less spoilage, fewer shutdowns, reduced unit cost with Tannate. *Try it!*

AT THE POWER SHOW-BOOTH 309

STEP UP PRODUCTION WITH

RHOADS *Tannate*

Established 1702

WATERSHED LEATHER BELTING

J. E. RHOADS & SONS • 35 N. SIXTH ST., PHILA., PA. • NEW YORK • CHICAGO • ATLANTA • CLEVELAND

COPY THIS INFORMATION FOR YOUR COMPRESSOR ROOM

. . . AND KEEP THIS IN YOUR REFERENCE FILE

To keep your Gardner-Denver air compressor at peak efficiency

1

Keep crankcase filled to proper level with high-grade engine oil, changing oil after every 200 hours.

2

Use only the best grade of air compressor oil for lubricating compressor cylinders.

3

Clean intake air filter at least once a week.

4

Test safety valves daily to prevent sticking.

5

Drain condensate from intercooler every day.

If you are looking for better—smoother—air compressor performance, remember these facts about a Gardner-Denver "RX" Compressor:

1

Dirt-free construction for longer compressor life and low maintenance.

2

High efficiency—due to better design which allows large and unrestricted valve and port areas. Extra large water jacket for better cooling.

3

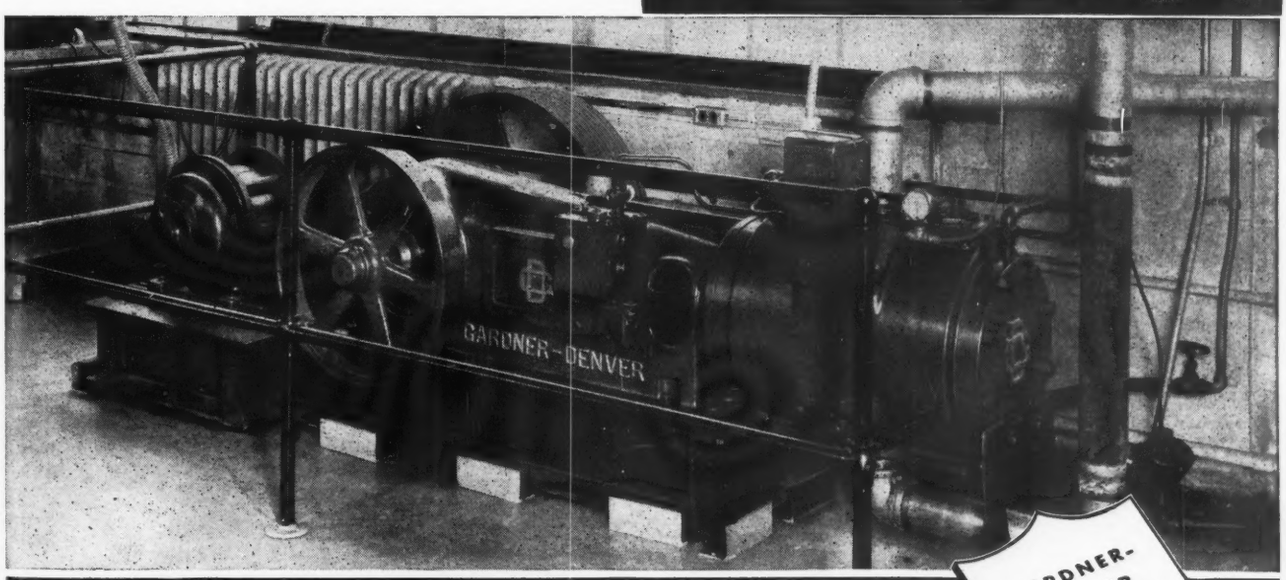
Efficient automatic capacity control—to fit air output to air needs.

4

Air-cushioned, silent, Duo-plate valves that actually get tighter with use.

5

Sized for a wide variety of needs—capacities from 89 to 1292 cubic foot displacement per minute.



For complete information, write Gardner-Denver Company, Quincy, Illinois

GARDNER-DENVER PRODUCTS KEEP SPEED V ICTORY

GARDNER-DENVER *Since 1859*

WHERE TO BUY

Featuring additional products and specialties for power plants

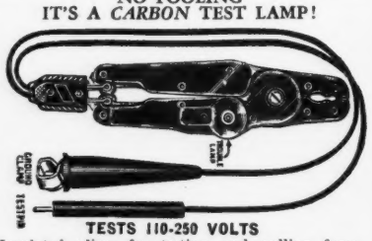
CHIMNEYS

Industrial Waste Burners

AMERICAN CHIMNEY CORP.
141 Fourth Ave.
New York City

BRANCHES: BOSTON
PHILADELPHIA · BUFFALO
CLEVELAND · DETROIT

NO FOOLING
IT'S A *CARBON* TEST LAMP!



TESTS 110-250 VOLTS
Insulated pliers for testing and pulling fuses. Folding prongs fit base plugs. Test cord attachable. Model B tests 110-600 Volts.
Can be obtained from G.E.—Westinghouse, or other first class jobbers
STAR TEST POCKETS PLIERS
235 Canal St. New York, N. Y.

USE LESS FUEL
GET MORE POWER

FIRE TUBE MODEL SHOWN

VIBRATAP CLEANER
● For fire tube and water tube boilers. Rapid vibration quickly breaks scale's grip on tubes. Fast, perfect cleaning—down goes fuel expense! Just try one! Also ask about our Mohawk power-driven Soot Scraper.

BRUNT EQUIPMENT CO.
60 S. DIVISION ST. BUFFALO, N. Y.

VOSS VALVES
INCREASED CAPACITY, SAVINGS IN POWER, SAFETY OF OPERATION
Made for all sizes of ammonia, air and gas compressors.
Send for estimates, literature and references.
J. H. H. VOSS CO., 785 East 144th St., New York, N. Y.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

NO DAMAGE
High Temperatured Oxyacetylene Torch Applied to Bricks Caused

FIRE BRICK WAS ARMOR-CLAD COATED
Then the same torch flame was applied to the *uncoated* side of the brick—which melted and ran after only 5 *seconds!* Do you want to increase furnace wall life 50% to 300%? Do you want to *seal* brick pores and joints and stop *slag?* Use Armor-Clad Coatings. Can't spall away. A Coating for every service. Low Cost. Send for circular—"Keeping America's Furnaces on the Firing Line." You fire furnaces *at once* after applying Armor-Clad.
ARMOR-CLAD COMPANY
Refractory Engineers
39 HYATT AVE. NEWARK, N. J.

AVAILABLE IMMEDIATELY
Precision Separators for Air, Steam, Gases—
for all temperatures, pressures and vacuum. For removal of liquids and solids. Self cleaning. Cooling or heating the gaseous material and complete recovery of the separated products.
PIONEER EQUIPMENT CORP. of AMERICA, Woolworth Bldg., New York

Sometimes you'll find it here . . .

WHEN you're in need of some product, equipment, device or service to speed production, save money, or improve products . . . you may find it here—in the Where to Buy Section.
Have you noticed these items in recent issues?

Adjustable Pipe Dies
Band Saws
Boilers
Circuit & Fuse Test Pliers
Coal Distributors
Compressed Air Dryers
Compressors
Conveyors
Gaskets
Girth Seam Protectors
Graph-Air Gun
Hand Tachometers
Isometric Paper
Lubricants
Mathematical Tables
Mica Undercutter
Pocket Test Pliers
Portable Welders
Power Scraper
Pumps
Rapid Calculator
Refractories
Resurfacers
Steam Cocks
Steel Floats
Valves
Waste Line Cleaners
Wrenches

It Pays to Check this page—each issue.

WeldELLS

WeldELLS have everything—

No other fittings for pipe welding combine the features found in WeldELL. In addition to that described, they include:

▶ **Seamless**—greater strength and uniformity.

▶ **Tangents**—keep weld away from zone of highest stress—simplify lining up.

▶ **Precision quarter-marked end**—simplify layout and help insure accuracy.

▶ **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.

▶ **Wall thickness never less than specification minimum**—assures full strength and long life.

▶ **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.

▶ **The most complete line of Welding Fittings and Forged Steel Flanges in the world**—insures complete service and undivided responsibility.

It's the difference between RIGHT and WRONG —*this "selective" reinforcement*

BOTH mathematical calculations and practical tests* prove that the bursting stresses in an elbow are greatest at the crotch or inner wall. That's why a special process is employed in producing WeldELLS which provides extra metal in this region of greatest stress as pointed out above. It is the nearest possible approach to the "One Hoss Shay" ideal of absolutely uniform strength throughout.

And it's also one more example of the length to which we have gone in producing WeldELLS to follow sound engineering considerations—considerations which mark the difference between right and nearly right.

An extra value, this—and opposite are listed other extra-value features that are combined in no other fittings for pipe welding. Yet: WeldELLS cost no more!

* The amount by which stress is greater at the crotch in a fitting having uniform wall thickness depends only on its radius. Mathematical analysis (specifically the Lorenz formula) shows the stress at the crotch to be:

$$S = \frac{pr\,(2R - r)}{2t\,(R - r)}$$

Where S = Bursting stress, lbs. per sq. in.
p = Internal pressure, lbs. per sq. in.
r = ½ inside diameter of fitting (O.D. if Barlow's formula is desired).
t = Wall thickness in inches.
R = Center line radius of fitting, inches.

Numerous tests by the Research Division of Taylor Forge show the formula given above to be somewhat on the conservative side.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

Easy, instant die change. Just push the size selector buttons and turn the head slightly.

TAKE GOOD CARE OF PIPE TOOLS TODAY

Keep them in good repair. Lubricate moving parts with a good grade of machine oil. Use a good grade of Sulphur Base Thread Cutting Oil. Keep the dies sharp. Above all do not abuse pipe tools today since metals are scarce and by prolonging their usefulness helps in the war effort. Save steel for victory—The Toledo Pipe Threading Machine Co., Toledo, Ohio—New York office, No. 2 Rector Street.

"TOLEDO"
MAKERS OF FINE
PIPE TOOLS, POWER PIPE MACHINES, VISES, BENCHES

Large or small, every Jarecki Valve has engineered into it a RESERVE of performance made possible by a policy of testing every valve far *beyond* its working pressure rating. Like money in the bank for a rainy day, that RESERVE comes in mighty handy in times of need!

JARECKI MFG. CO.

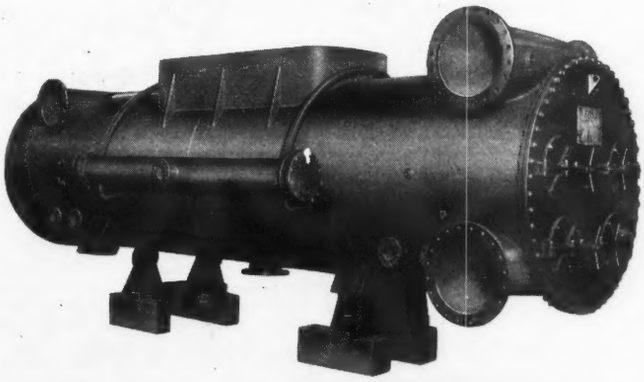
ERIE, PA. U. S. A.

ROSS

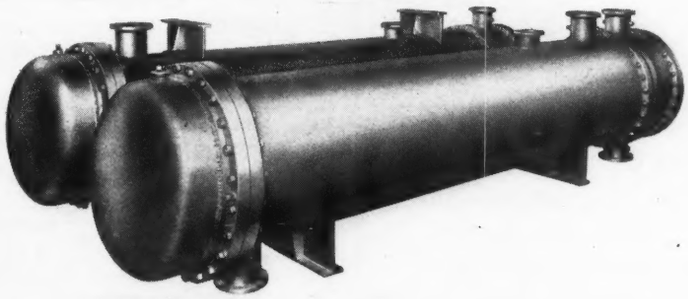
INTER OFFICE MEMO

POWER PLANTS EVERYWHERE

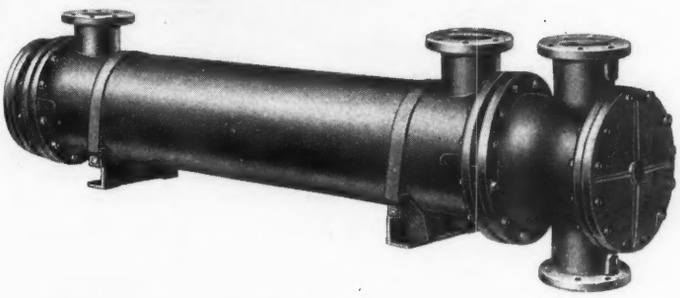
Ross shell and tube equipment efficiently covers every requirement where heat must be transferred from one fluid to another.



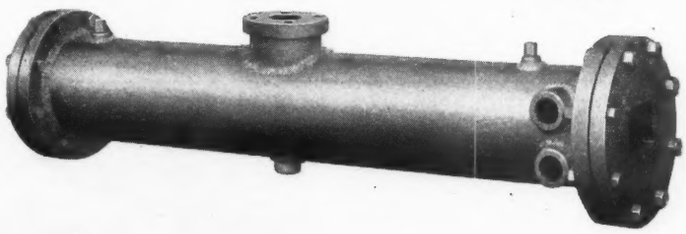
SURFACE CONDENSERS
STANDARD AND SPECIALLY ENGINEERED



HEAT EXCHANGERS
STANDARD AND SPECIALLY ENGINEERED



STANDARD LUBE OIL & JACKET WATER
COOLERS



FUEL OIL HEATERS

FULLY ILLUSTRATED AND INFORMATIVE BOOKS
Sent Free
TO PLANT EXECUTIVES AND CHIEF ENGINEERS
WRITING REQUEST ON COMPANY LETTERHEAD

ROSS HEATER & MFG. COMPANY, Inc.
Division of AMERICAN Radiator and "Standard" Sanitary Corporation
GENERAL OFFICES AND PLANT--BUFFALO, N. Y.

BROWNELL STOKERS

For those interested in a *good* stoker for plant, institution, office building, hotel, apartment or home, there's a Brownell Underfeed to suit your requirements up to 500 h.p. with single retort—larger industrial sizes with twin retorts.

Write for illustrated bulletin

THE BROWNELL COMPANY — the World Over — SINCE 1858 — DAYTON, OHIO, U.S.A.

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COLUMBIA ENGINEERING CORP.
STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS
War Plant Design - Supervision of Construction - Engineering Reports
61 Broadway, New York, N. Y. — 323 Plum Street, Cincinnati, Ohio

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Business Studies, New Projects, Purchase-Sales, Management, Valuations, Reorganizations, Mergers, Public Utility Affair (including Integration)
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CONSULTANTS ON
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LANCASTER, ALLWINE & ROMMEL
Patents—Copyrights—Trade Marks
Booklets—General Information Concerning Inventions & Patents" and "Free Schedule" sent without obligation.
Established 1915
Suite 456, 815—15th St., N.W., Washington, D. C.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

NO TIME TO EXPERIMENT . . .
So why not save time by calling in a specialist who knows the ground you are exploring?

LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Power, published monthly with an additional Directory number in December, at Albany, N. Y., for October 1, 1942.

State of New York } ss.
County of New York }

Before me a Notary Public in and for the State and county aforesaid, personally appeared J. A. Gerardi, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Power, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Editor, Philip W. Swain, 330 West 42nd St., N. Y. C. Managing Editor, None. Business Manager, N. O. Wynkoop, 330 West 42nd St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder, the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42nd St., N. Y. C. James H. McGraw, Jr., 330 West 42nd St., N. Y. C. James H. McGraw, James H. McGraw, Jr., and Curtis W. McGraw, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw, 330 West 42nd St., N. Y. C. Curtis W. McGraw, 330 West 42nd St., N. Y. C. Donald C. McGraw, 330 West 42nd St., N. Y. C. Anne Hugus Britton, 330 West 42nd St., N. Y. C. Mildred W. McGraw, Madison, N. J. Grace W. Mehren, 73 No. Country Club Drive, Pheonix, Ariz. J. Malcolm Muir & Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 140 Broadway, N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the names of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is. (This information is required from daily publications only.)

J. A. GERARDI, Secretary.
McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 29th day of September, 1942.

[SEAL] CHESTER W. DIBBLE.

Notary Public, Queens County. Queens County Clerk's No. 4166. Certificate filed in N. Y. Co. Clerk's No. 889.

(My commission expires March 30, 1943)

Another Timely Power Show!

● Our government urges us "to make the most of what we have", to save materials and production for our supreme job—winning this war. In the power industry, this spirit is fostering the pooling of generating capacity, manpower, and equipment, to meet war-production power needs. Idle, usable, power equipment must be put to work or scrapped because "to make the most of what we have" in this way will reduce demands on manufacturers for *new* equipment, and so make more material and production capacity available for munitions.

In the same spirit, this issue of *Power* features "Another Timely Power Show" of

USED POWER EQUIPMENT

Steam • Gas • Oil • Electric Accessories Surplus-New Equipment

Available for War-Production Power Needs

● Power equipment listed in advertisements on the following pages is offered both by dealers and by user-owners. Practically all of it is available for immediate delivery. It includes equipment rebuilt to first-class operating condition by dealers who offer it with specific guarantees, and equipment that is offered "as is". (The services of many dealers are available to you to rebuild existing equipment where conditions require it, including—if necessary—the rental of suitable equipment over the time required for rebuilding.)

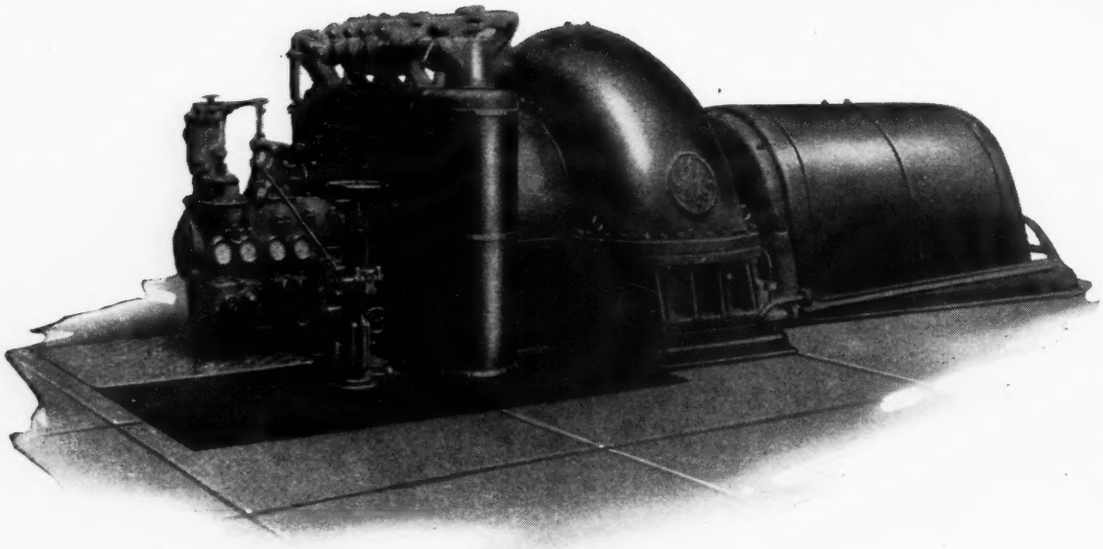
The buying and selling of used power equipment by dealers is not a war-born industry. At least one dealer has served the power field for over 40 years —many over 25 years. These dealers are recognized—and reputable—sources of used power equipment.

Naturally, current demand for some types and capacities of equipment exceeds the supply. Supplementing and furthering the government's urgent request to user-owners to make all idle used or surplus new power equipment available to those who need it, we recommend that readers having such equipment bring it to the attention of these dealers immediately.

These dealers may be offering in their advertisements just what you need; they may also have a waiting buyer—or buyers—urgently in need of equipment for which you have no further use.

For your convenience, an advertisers' index and a classified index of the used power equipment offered in these pages appear on page 292.

ELECTRICAL POWE



Actual Photograph

3125 KVA GENERAL ELECTRIC CONDENSING TURBO UNIT

3125 KVA General Electric Alternating current generator, 3 phase 60 cycle 2400/4160 volts 3600 RPM direct connected to General Electric condensing turbine 225-400 lbs. steam pressure 700 deg. TT. Equipped with surface condenser and auxiliaries.

ALTERNATING CURRENT TURBO GENERATORS

3 Phase 60 Cycle

9375 KVA GENERAL ELECTRIC condensing, 225 lbs. pressure, 100 deg. superheat, 1800 RPM with surface condenser; 4800 volts.

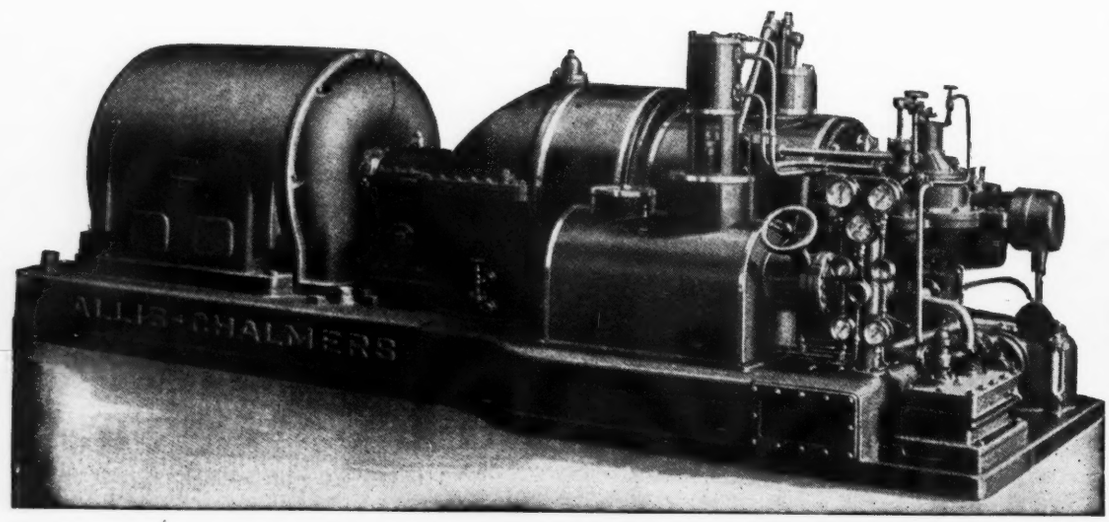
6250 KVA GENERAL ELECTRIC condensing, 220-225 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

3125 KVA GENERAL ELECTRIC condensing, 225-400 lbs. pressure, 700 deg. TT, 3600 RPM with surface condenser; 2300/4160 volts.

1250 KVA ALLIS CHALMERS condensing, 150-200 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

SURFACE CONDENSER

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps.



Actual Photograph

1250 KVA ALLIS CHALMERS CONDENSING TURBO UNIT

1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

DIRECT CURRENT ENGINE GENERATORS

125/250 Volts 3-Wire

150 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0.8 lbs. back pressure, 360 RPM.

125 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0.8 lbs. back pressure, 360 RPM.

ALTERNATING CURRENT ENGINE GENERATORS

3 Phase 60 Cycle

210 KVA GENERAL ELECTRIC-AMES uniflow, 125-150 lbs. steam pressure 0-5 lbs. back pressure, 225 RPM; 2300-600-480-240 volts

210 KVA GENERAL ELECTRIC-SKINNER uniflow, 120-150 lbs. steam pressure 0-3 lbs. back pressure, 225 RPM; 2300-600-480-240 volts

210 KVA GENERAL ELECTRIC, 2300-600-480-240 volts, 225 RPM (GENERATOR ONLY)

THE NATIONAL POWER

WER EQUIPMENT

ROTARY CONVERTERS

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers.

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers.

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers.

1000 KW (2) WESTINGHOUSE, 250 volts D.C., 360 RPM with 3 phase 60 cycle 13200/158 volt transformers.

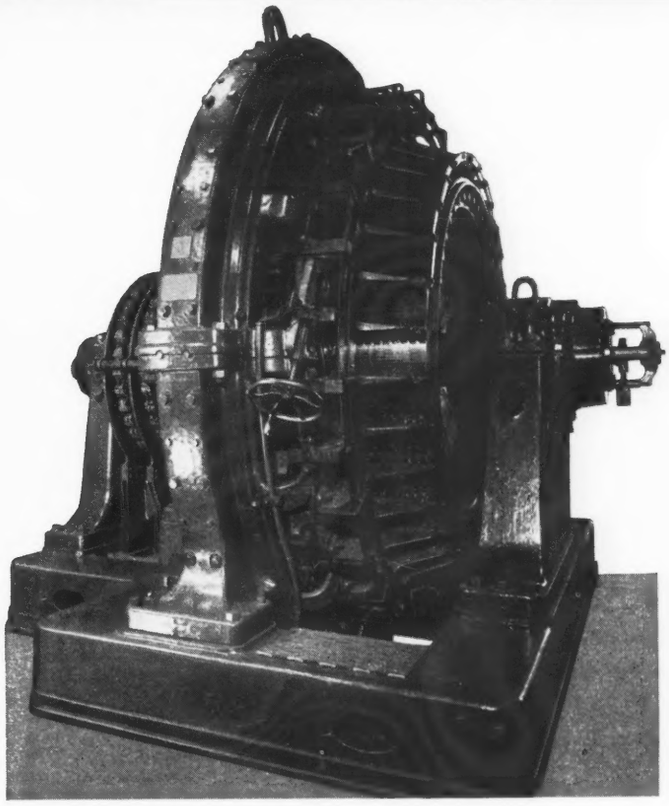
750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers.

500 KW (2) WESTINGHOUSE, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 6600-445/222 volt transformers.

ROTARY CONVERTERS

25 Cycle

1500 KW WESTINGHOUSE,, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformers.



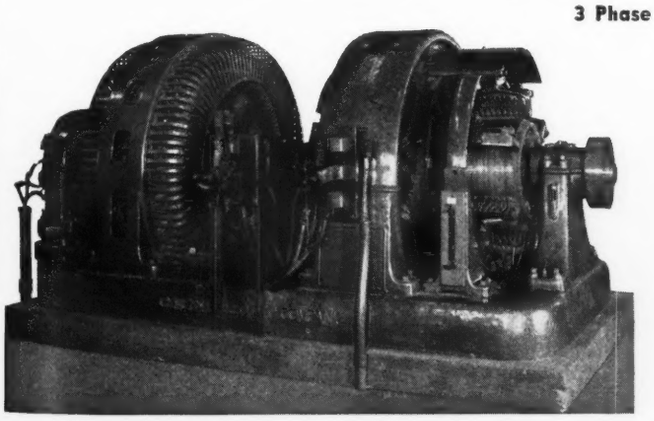
3500 KW (2) Westinghouse booster type interpole, rotary converters, 225-285 volts D.C. 225 RPM; 6 phase 60 cycle A.C. with 3 phase 60 cycle 13,200 volt transformers. Complete with control.

Actual Photograph

3500 KW WESTINGHOUSE ROTARY CONVERTER

MOTOR GENERATOR SETS

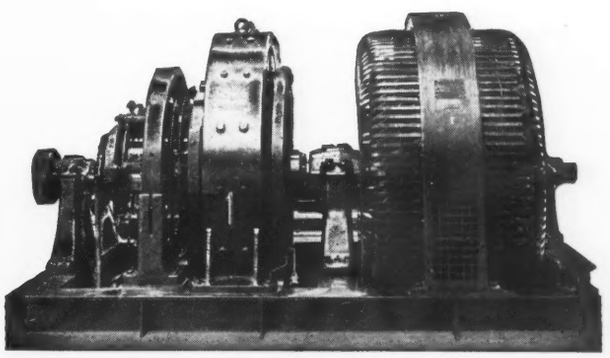
3 Phase 60 Cycle



Actual Photograph

750 KW GENERAL ELECTRIC MOTOR GENERATOR SET

750 KW GENERAL ELECTRIC direct current generator, 600 volts 720 RPM direct connected to 1100 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

The 2 Big Questions:

What's available?

Who can supply it?

MOTORS GENERATOR SETS

2—200 KW, 250 volt, Electric Machinery, syn.
1— 75 KW, 125 volt, GE, sq. cg.
1— 50 KW, 125 volt, Crocker Wheeler, sq. cg.
1— 20 KW, 600 volt, GE, sq. cg.
1— 15 KW, 250 volt, GE, sq. cg.

DC GENERATORS

1—500 KW, 720 RPM, 650 volt, GE.
1— 75 KW, 675 RPM, 125 volt, Westinghouse.
1— 75 KW, 260 RPM, 250 volt, Westinghouse.
1— 15 KW, 900 RPM, 115 volt, Burke.

MOTORS—3 Phase 60 Cycle

1—720 HP, 360 RPM, 440 volt, GE, syn.
1—500 HP, 1200 RPM, 440 volt, GE, syn.
1—500 HP, 900 RPM, 440 volt, Lincoln, slip ring
1—400 HP, 514 RPM, 440 volt, Westinghouse, slip ring.
1—350 HP, 100 RPM, 220/440 volt, GE, syn.
1—350 HP, 300 RPM, 440 volt, GE, slip ring.
1—335 HP, 600 RPM, 2300 volt, GE, syn.
1—300 HP, 720 RPM, 2300 volt, GE, slip ring.
1—250 HP, 514 RPM, 4000 volt, GE, syn.
1—250 HP, 600 RPM, 4000 volt, GE, syn.
1—250 HP, 600 RPM, 220 volt, GE, slip ring.
1—200 HP, 900 RPM, 440 volt, Westinghouse, slip ring.
1—200 HP, 600 RPM, 2200 volt, GE, slip ring.
1—200 HP, 600 RPM, 440 volt, Crocker Wheeler, slip ring.
1—200 HP, 600 RPM, 550 volt, GE, sq. cg.

MOTORS (Continued)

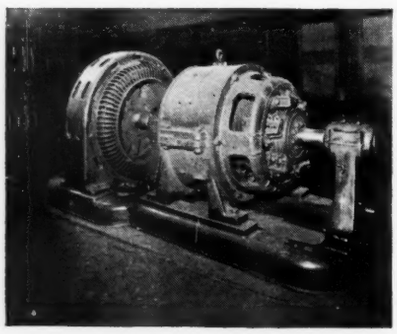
1—200 HP, 450 RPM, 2200/4000 volt, GE, slip ring.
1—150 HP, 1800 RPM, 2300 volt, Allis Chalmers, sq. cg.
1—150 HP, 1800 RPM, 440 volt, Westinghouse, sq. cg.
1—150 HP, 1200 RPM, 440 volt, Westinghouse, sq. cg.
1—150 HP, 900 RPM, 440 volt, Allis Chalmers, slip ring.
1—150 HP, 720 RPM, 440 volt, GE, slip ring.
1—150 HP, 600 RPM, 440 volt, GE, slip ring.
1—150 HP, 400 RPM, 440 volt, GE, sq. cg.
1—125 HP, 720 RPM, 440 volt, GE, slip ring.
1—100 HP, 1800 RPM, 440 volt, Westinghouse sq. cg.
1—100 HP, 900 RPM, 440 volt, GE, slip ring.
1—100 HP, 900 RPM, 440, Westinghouse, sq. cg.
1—100 HP, 720 RPM, 440 volt, GE, slip ring.
1—100 HP, 720 RPM, 440 volt, GE, sq. cg.
1—100 HP, 600 RPM, 440 volt, GE, slip ring.
1—100 HP, 600 RPM, 2300 volt, GE, slip ring.
1—100 HP, 600 RPM, 440 volt, GE, sq. cg.
1—100 HP, 514 RPM, 440 volt, GE, sq. cg.
1—100 HP, 450 RPM, 440 volt, GE, sq. cg.
1— 90 HP, 400 RPM, 550 volt, Crocker Wheeler, sq. cg.
1— 75 HP, 900 RPM, 4000 volt, Electric Machinery, syn.
1— 75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
1— 75 HP, 900 RPM, 440 volt, GE, sq. cg.
1— 75 HP, 900 RPM, 2200 volt, GE, slip ring.
1— 75 HP, 720 RPM, 440 volt, Westinghouse, slip ring.

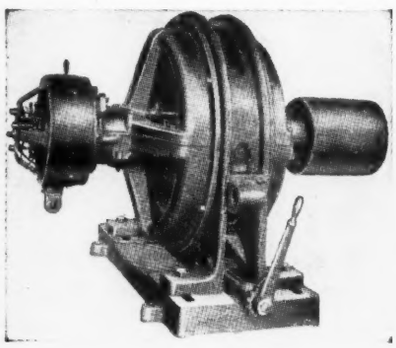
MOTORS (Continued)

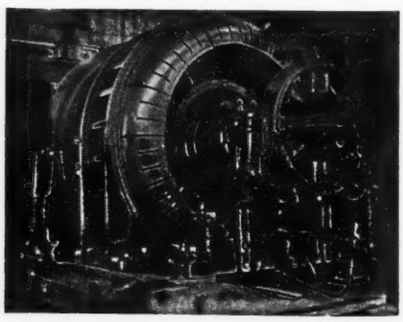
1— 75 HP, 720 RPM, 440 volt, GE, sq. cg.
1— 50 HP, 1800 RPM, 220 volt, Fairbanks-Morse, slip ring.
1— 50 HP, 900 RPM, 440 volt, GE, slip ring.
1— 50 HP, 900 RPM, 440 volt, GE, sq. cg.
1— 50 HP, 720 RPM, 220 volt, GE, sq. cg.
1— 50 HP, 720 RPM, 220 volt, Westinghouse, slip ring.
1— 50 HP, 600 RPM, 440 volt, Westinghouse sq. cg.
1— 40 HP, 1200 RPM, 2200 volt, GE, slip ring.
1— 40 HP, 1200 RPM, 440 volt, GE, slip ring.
1— 40 HP, 900 RPM, 2200 volt, GE, slip ring.
1— 40 HP, 900 RPM, 220 volt, GE, sq. cg.
1— 40 HP, 720 RPM, 220 volt, Westinghouse, slip ring.

MOTORS—DC 230 Volts

1—250 HP, 750 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse.
1—100 HP, 625 RPM, GE.
1—100 HP, 575 RPM, GE.
1— 90 HP, 900 RPM, GE.
1— 75 HP, 950 RPM, GE.
1— 65 HP, 1000 RPM, GE.
1— 50 HP, 750 RPM, Westinghouse.
1— 50 HP, 700 RPM, Crocker Wheeler.
1— 40 HP, 775 RPM, Westinghouse.
1— 30 HP, 725 RPM, Westinghouse.
1— 25 HP, 1150 RPM, Fairbanks-Morse.
1— 15 HP, 1400 RPM, Star.
1— 15 HP, 1150 RPM, Star.







J. L. HEMPHILL & CO.

Answered!

"HEMPHILL"!

MOTORS—Variable Speed 230 Volts

2—100 HP, 475/1375 RPM, Electro Dynamic.
1— 90 HP, 475/940 RPM, GE.
1— 75 HP, 525/1575 RPM, Electro Dynamic.
1— 60 HP, 600/1200 RPM, GE.
1— 60 HP, 500/1000 RPM, Diehl.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 35 HP, 350/1050 RPM, Electro Dynamic.
1— 30 HP, 225/900 RPM, Crocker Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, GE.
1— 15 HP, 300/1200 RPM, GE.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—7½/10 HP, 500/1500 RPM, Reliance.
1—6/7½ HP, 450/1800 RPM, Crocker Wheeler.
1— 5 HP, 600/1200 RPM, GE.
1— 5 HP, 600/1200 RPM, Reliance.
1— 5 HP, 450/1800 RPM, Crocker Wheeler.
1— 5 HP, 400/1600 RPM, Diehl.
6— 5 HP, 400/1200 RPM, Westinghouse.
1— 5 HP, 225/900 RPM, Electro Dynamic.
1—4½ HP, 600/1800 RPM, GE.
1— 3 HP, 500/2000 RPM, Westinghouse.
1—2½ HP, 450/1800 RPM, Westinghouse.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, GE.
1—400 KVA, 400 RPM, 240 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers.

TURBO—GENERATORS

2—1000 KW, 3 phase, 60 cycle, 2300/4150 volt, condensing.
1— 600 KW, Terry, dual bleeder, condensing turbine only.
1— 500 KW, GE, 3 phase, 60 cycle, 480 volt, bleeder.
1— 500 HP, 3600 RPM, GE, non-condensing turbine only.
1— 375 KVA, 2300 volt, Westinghouse, non-condensing.
1— 300 KW, GE, 3 phase, 60 cycle, 220 volt, condensing.
1— 200 KW, GE, 3 phase, 60 cycle, 220 volt, condensing.
1— 250 KW, Westinghouse, non-condensing turbine only, with reduction gear to 900 RPM.
1— 150 HP, Terry turbine only, with reduction gear to 295 RPM.

TRANSFORMERS

2—400 KVA, GE, 4156-240/480 volts, Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
3—250 KVA, GE, 6600/2200-220/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts.
2—200 KVA, GE, 2300/4600 - 230/460 volts, Scott taps.
3—150 KVA, GE, 33,000-2300 volts.
3—150 KVA, Pittsburgh, 6600/440 volts.
1—150 KVA, GE, 2400-120/240 volts.
3—100 KVA, Westinghouse, 13,200/250 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750 - 110/220 volts.

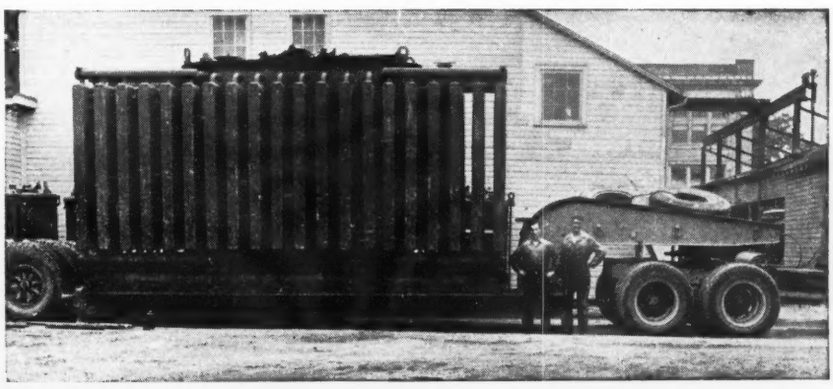
TRANSFORMERS (Continued)

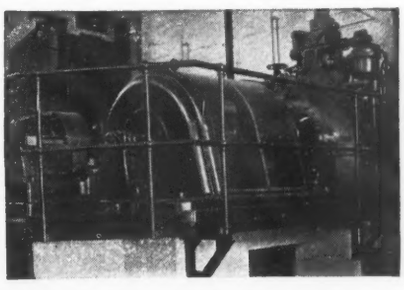
1—100 KVA, GE, 2200-110/220 volts.
3— 75 KVA, GE, 13,500-7500/440 volts.
1— 75 KVA, GE, 3 phase, 4156Y-120/208Y.
2— 50 KVA, Pittsburgh, 7500/15,000 volts-110/220 volts.
3— 50 KVA, Wagner, 4150/220 volts.
2— 50 KVA, GE, 2200-220/110 volts.
14— 37½ KVA, GE, 2400-120/240 Volts.
2— 37½ KVA, GE, 2200/220/440 volts.
1— 30 KVA, Westinghouse, 2200-220/110 volts.
2— 25 KVA, GE, 4600-230/460 volts.
8— 25 KVA, Westinghouse, aircooled, 440-110/220 volts.
1— 25 KVA, Packard, 230-115/230 volts.
1— 25 KVA, GE, 220-220/110 volts.
2— 15 KVA, Westinghouse, 2300/230 volts.
3— 10 KVA,GE, 2200-110/220 volts.
1— 7½ KVA, GE, 440-110/220 volts.
1— 5 KVA, GE, 4150-120/240 volts.
2— 5 KVA, GE, 2200-110/220 volts.
4— 5 KVA, GE, 440-110/220 volts.
3— 4 KVA., GE, 2200-110/220 volts.
1— 3 KVA, Moloney, 440-110/220 volts.
3— 2½ KVA, GE, 2200-110/220 volts.
1— 2 KVA, Newark, aircooled, 440-110 volts.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 volt, 3 pole, GE, Type FK-130.
1—3000 amp., 600 volt, 4 pole, GE, Type FK-24.
1—1600 amp., 7500 volt, 4 pole, Westinghouse, B-2.
1—1200 amp., 15,000 volt, 4 pole, Westinghouse, B-2.
3—1200 amp., 26,000 volt, GE, Type H-206, motor operated, indoor type.

Also complete stock of similar sizes.



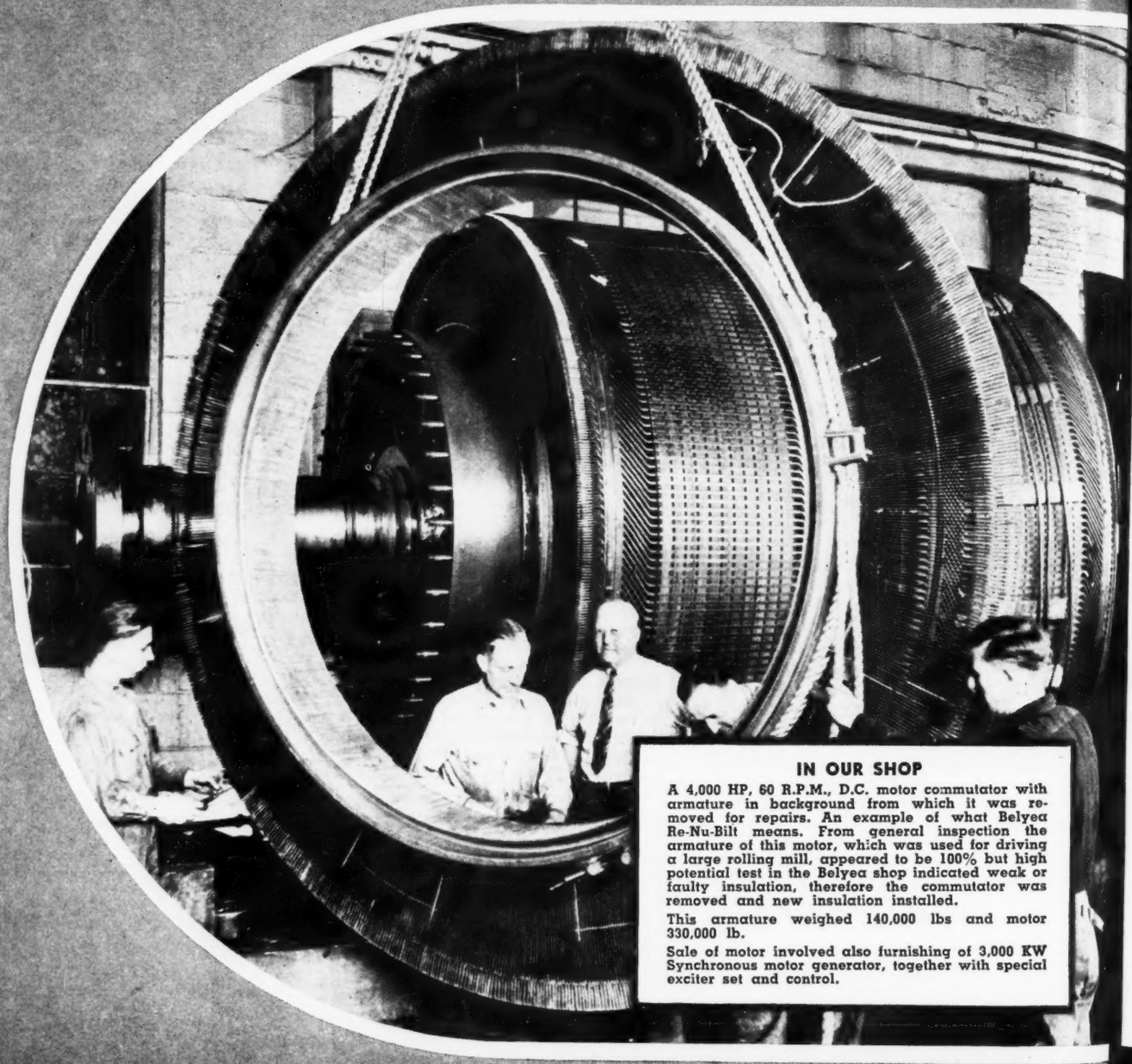


POWER EQUIPMENT

1602 53rd STREET, NORTH BERGEN, N. J.

PHONES: NEW YORK: LOngacre 5-3227 • NEW JERSEY: UNion 3-2600

RE-NU-BILT BY BELYEA



IN OUR SHOP

A 4,000 HP, 60 R.P.M., D.C. motor commutator with armature in background from which it was removed for repairs. An example of what Belyea Re-Nu-Bilt means. From general inspection the armature of this motor, which was used for driving a large rolling mill, appeared to be 100% but high potential test in the Belyea shop indicated weak or faulty insulation, therefore the commutator was removed and new insulation installed.

This armature weighed 140,000 lbs and motor 330,000 lb.

Sale of motor involved also furnishing of 3,000 KW Synchronous motor generator, together with special exciter set and control.

BELYEA COMPANY, INC.

Main Office and Shop

32 HOWELL ST., JERSEY CITY, N.J.

• • • POWER TO WIN

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW GE 600 V Gen d.c. to 2100 HP 6600 V Syn. motor.

1 —500 KW Whse 250 V Gen d.c. to 700 HP 2300 V Syn, motor.

1— 500 KW GE 600 V Gen. d.c. to 700 HP 13200 V Syn. motor.

1— 150 KW GE 550 V Gen. d.c. to 225 HP 2300 V Syn. motor.

ROTARY CONVERTERS

60 cycle

1—1500 KW Whse 720 RPM 650 V DC with transformers 33000 V and panels.

1—1250 KW GE 720 RPM 250 V DC with transformers 2300 V and panels.

2— 750 KW Whse 1200 RPM 600 V DC with transformers 2300/6600 V and panels. 25 cycle.

25 cycle

3—1500 KW GE 500 RPM 225/275 V DC Booster type with 6600 V transformers and panels. **Actual photo** of one at right side center cut.

1— 500 KW GE 750 RPM 225/275 DC Booster type with 660 transformers and panels.

TURBO GENERATOR SETS

1—500 KW Whse 625 Kva 440 V 3 ph 60 cy 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

1—500 KW GE 625 Kva 2300 V 3 ph 60 cy with Curtis 4 stage 150 lb. condensing turbine with condenser and accessories.

1—75 KW Ridgeway 250 V DC with Terry turbine 180 lb. pressure with 12 lb. back pressure. 2000 RPM.

ENGINE GENERATOR SET

1—100 KW Whse DC Gen 125/250 V 3 wire, 250 RPM dir conn 150 HP 14x15 Skinner engine 150 lb. pressure.

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1500	Whse.		550	330
2—1250	G.E.	MPC	500	130
1—800	G.E.	MPC	550	600
1—625	G.E.	MPC	250	130
1—600	G.E.	MPC	550	600/800
1—600	Whse.		230	150/275
2—350	G.E.	MPC	230	450
1—300	G.E.	MPC	230	275/550
1—300	G.E.	MPC	230	250/400
1—200	Whse.		230	400/500
2—150	Whse.	SK	230	300/900
1—100	Al.Ch.		230	950/1150

A.C. MOTORS

3 phase—60 cycle

SLIP RING

HP	Make	Type	Volts	Speed
1—1200	Al.Ch.	ANY	2300	505
1—800	Al.Ch.	ANY	440	885
1—600	G.E.	IM	2200	900
1—450	Whse.	HW	2200	875
1—400	Al.Ch.	ANY	440	1200
1—400	G.E.	MT	550/440	300
1—400	Al.Ch.	ANY	2300	505
1—350	G.E.	MT-442	2300/4000	257
1—250	G.E.	MT	4000/2300	257
1—250	G.E.	MT-410	2300	390
2—200	Whse.	CW	2200	514
2—175	G.E.	IE-15A	2200	880

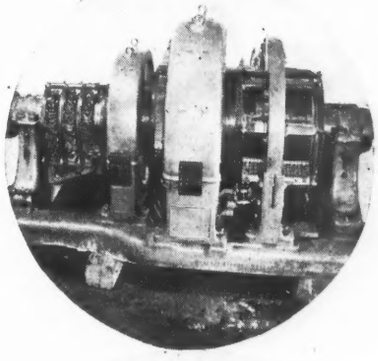
SQUIRREL CAGE

HP	Make	Type	Volts	Speed
1—500	G.E.	I-17B	2200	690
1—300	Whse.	CS	550	580
1—300	Al.Ch.		2200	1160
1—300	G.E.	IK	440/2300	600
1—250	Al.Ch.		220/440	1150
1—200	G.E.	IK	2200	490
1—200	Whse.	CS	4600	900
1—200	Whse.	CS	550	720
1—200	Al.Ch.		2200	1750
1—200	Whse.	CS	440	580
1—150	Al.Ch.	AN	220/440	1750

TRANSFORMERS

60 cycle

Kva	Make	Ph	Type	Voltages
1—1500	Whse.	3	OISC	26400/13200x440
3—1000	G.E.	1	HKDD	13200x2300
3—300	Pitts.	1	OISC	2300x115/230
3—300	G.E.	1	H	13200x2300/575
3—200	G.E.	1	HLLD	26400x115/460
3—150	Whse.	1	SKM	2400x120/240
1—150	G.E.	3	HT	2300/4000x115
3—100	Whse.	1	OISC	13200x250
4—75	Pitts.	1	OISC	2300x575



Specials

RE-NU-BILT BELYEA MOTORS

SYNCHRONOUS CONDENSER.

4000 kva G.E. Synchronous Condenser 13200 v., 3 ph., 60 cycle with 1150 HP., 13200 v. Starting motor and exciter.

GEAR SETS

1 — 2100 HP. Whse. . . . . 1800/375 RPM.
1 — 943 HP. G.E. . . . . 5306/1200 RPM.
1 — 720 HP. DeLaval . . . . . 3600/600 RPM.

RE-NU-BILT BELYEA MOTORS

Idle-USAble equipment is next to

STANDBY-EQUIPMENT CAN'T JUST GET IT INTO

Check this list of equipment *for prompt shipment*

HERE'S A LIST OF EQUIPMENT WE CAN DELIVER NOW FOR WAR PRODUCTION

MOTOR GENERATOR SETS

Late Type 500 KW Westinghouse Syn. Motor Generator Set

Motor—714 HP 3 ph. 60 cycle 4100 Volts 900 RPM 80% PF 900 RPM

Generator—500 KW 250/125 Volts 2000 Amps 900 RPM Complete with Manual AC & DC Controls

150 KW General Electric, 250 Volts motor generator set, 900 RPM 3 phase, 60 cycle, 2300 Volts.

SEND YOUR LIST OF IDLE USABLE EQUIPMENT TO

SYNCHRONOUS MOTORS

200 H.P. G.E.—TS—514 RPM.
55 H.P. Elec. Machy., 1200 RPM.
90 H.P. West, 900 RPM.

SLIPRING MOTORS

250 H.P. G.E., 600 RPM.
200 H.P. G.E., 720 RPM.
200 H.P. G.E., 514 RPM.
125 H.P. Burke, 600 RPM.
75 H.P. West., 1200 RPM. (5).
64 H.P. G.E., 585 RPM.
60 H.P. West., 1200 RPM.
60 H.P. West., 290 RPM.

(180 additional slipring motors, 1 to 50 H.P. in stock.)

SQUIRREL CAGE MOTORS

200 H.P. G.E., 600 RPM.
150 H.P. Falk. Morse, 1800 RPM.
75 H.P. Burke, 1200 RPM.
60 H.P. G.E., 1800 RPM.
50 H.P. West., 900 RPM.
50 H.P. Allis Ch., 720 RPM.
50 H.P. G.E., 720 RPM.
50 H.P. G.E., 600 RPM.

(310 additional squirrel cage motors in stock, ¼ to 50 H.P.)

A.C. GENERATORS

200 KW G.E., 600 RPM.
150 KW G.E., 720 RPM.
100 KVA Cr. Wheeler, 900 RPM.
100 KVA West., 600 RPM.
90 KVA G.E., 900 RPM.
75 West., 900 RPM.

230 VOLT D.C. MOTOR GEN. SETS

500 KW West., 900 RPM.
125 KW Curtis, steam turbine dr.
150 KW G.E., 900 RPM.
25 KW G.E., 1800 RPM.

(18 additional sets in stock, 1 to 25 KW.)

125 V. MOTOR GEN. SETS

90 KW G.E.
75 KW Ridgway Syn. 1200 RPM.
35 KW G.E. Steam Turbine.

(19 additional 125 V. M.G. Sets in stock, ½ to 25 KW.)

550 VOLT D.C. MOTORS

25 H.P. G.E., 875 RPM.
20 H.P. G.E., 1700 RPM.
20 H.P. G.E., 895 RPM.
15 H.P. G.E., 2100 RPM. (2).
15 H.P. G.E., 1350 RPM
7½ H.P. G.E., 900 RPM.
5 H.P. West., 1100 RPM.
3 H.P. G.E., 1800 RPM.

(12 additional motors in stock, ¼ H.P. up.)

230 VOLT D.C. MOTORS

165 H.P. Cr. Wheeler, 670 RPM.
100 H.P. Reliance, 1150 RPM. (2).
60 H.P. G.E., 1050 RPM.
60 H.P. G.E., 900 RPM.
60 H.P. Roth, 600 RPM.
50 H.P. G.E., 850 RPM.
40 H.P. El. Dyn., 1450/2600 RPM.

230 VOLT D.C. MOTORS

40 H.P. G.E., 1700 RPM.
40 H.P. Allis Ch., 1150 RPM.
40 H.P. Reliance, 625 RPM.
40 H.P. G.E., 440/800 RPM.
30 H.P. West., 500/1500 RPM.
25 H.P. G.E., 1150 RPM. (3).
25 H.P. West., 850 RPM (2).
25 H.P. G.E., 575 RPM.
20 H.P. G.E., 1750 RPM.

(235 additional motors, ½ to 20 H.P. in stock.)

115 VOLT D.C. MOTORS

90 H.P. G.E., 900 RPM.
65 H.P. G.E., 550 RPM.
20 H.P. Sprague, 1250 RPM.
15 H.P. G.E., 1150 RPM.
10 H.P. LA., 3600 RPM.
10 H.P. F.M., 1150 RPM.
10 H.P. West., 850 RPM.
7½ H.P. G.E., 1750 RPM.
7½ H.P. West., 1150 RPM.
7½ H.P. G.E., 850 RPM.

(215 additional 115 volt D.C. Motors, ½ to 5 H.P., also in stock.)

MISCELLANEOUS

5 H.P. B & D 230 volt buffer.
40—A.C. & D.C. Fans and Blowers.
11—Motor Driven Freq. Changers 90 to 180 cycles.
14x10 Ing. Rand Compressor, 503 ft. at 60 lbs. pressure.
12½x12 American Compressor, 390.

L. J. LAND and CO.

146 Grand St.—Canal 6-3923—New York, N. Y. **READING, PENNA., Office: 10th and Exeter Sts.**

Over Quarter Century Serving Industry

MOVING PICTURE of a BATTLE on the Working Front

EVERY BATTLE is the sum of a thousand little battles, every victory the total of many little victories . . . Not all of them are won in the front lines. Our particular foxhole is on the working front. Our objective is to increase the production of war materials. Our "weapons" for you are Steam Engines and Turbo-Generator Sets, Diesels, Electric Motors and Generators, Motor Generator Sets, Rotary Converters, Boilers, Pumps, Air Compressors, Blowers, Fans—in fact everything from a pulley to a complete powerhouse. Our "bullets" are telegrams, telephone calls and letters, and we shoot round after round of them trying to run down leads flashed by our "intelligence", locating and placing in production these weapons.

This is a job we understand. A job we're well fitted by 27 years of experience to do. And a job that has a place in the grand strategy of war. For grand strategy is economic as well as military and used power plant equipment—located, reconditioned, and redistributed by dealers like ourselves—saves time and labor and material.

Except for the necessary expert reconditioning done in our shops, rebuilt equipment is an inheritance of labor and material from peaceful yesteryears—when men and metals were plentiful and not critical. And except for the brief time required for reconditioning, rebuilt equipment goes to work for Victory months before new equipment could be delivered. We'll win our own little battle or die trying.

We are also representatives in the Philadelphia area for many of the leading national manufacturers of new machinery

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET • PHILADELPHIA - PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN-PHILA

REBUILT POWER PLANT EQUIPMENT A GODSEND

Ready for delivery in jig time . . . without bottlenecking vital men, materials and machines

A.C.—STEAM ENGINE UNITS—D.C.

450 KW Nordburg Uniflow, 250 volt D.C.
(2)—300 KW Skinner Uniflow, 250 volt D.C., serial over 10,000.
300 KW Cr.Wh.—Fitchburg, 4-valve, 250 volt D.C. Phila. Stock.
250 KW G.E., 3/60/220/440/2300, 200 RPM; direct con. Chuse-Ridgeway Uniflow, non-cond. Phila. warehouse stock.
200 KW Skinner Uniflow, 125 volt D.C.
150 KW Harrisburg Uniflow, 125 volt D.C.
50 KVA West. 3/60/220/440/2300, 300 RPM; Harrisburg Fleming piston valve, automatic Engine. Phila. stock.

COMPLETE POWER PLANT No. 1

1—750 KW Al.Ch.—Moore Bleeder Non-Condensing Turbo Generator Set, 3 ph., 60 cycle, 480 volt, 3600 RPM; built for 190# gauge, 100 deg. F.S. Superheat, bleeding at 75#, exhausting at 10#. Adjustable nozzle to carry full load with 160# gauge saturated. All accessories included.

— A L S O —

2—633 HP Bigelow Hornsby W. T. Boilers, 225# ASME with water softener, feed water heater, boiler feed pumps, draft fans, pre-heaters, all trimmings.

LOCATED IN PHILADELPHIA AREA NOW IN USE
IMMEDIATE RELEASE

A.C. TURBINE UNITS

4000 KVA Al.Ch. Cond., 3/60/2300/3600 RPM.
3125 KVA G. E.—Curtis Cond., 3/60/2300/3600 RPM.
2500 KVA West. Cond., 3/60/600/3600 RPM.
1500 KVA West. Cond., 3/60/2300/3600 RPM.
1250 KVA G. E.—Curtis Cond., 2/60/2300/3600 RPM.
937 KVA Al.Ch.—Moore bleeder type, non-cond., 3/60/480/3600 RPM, 75# bleed.
750 KVA G. E. Cond., 3/60/600/3600 RPM.
625 KVA G. E.—Curtis Cond., 2/60/2300/3600 RPM.
625 KVA West. Non-cond., geared, 3/60/2300 volt, 6000/900 RPM.
500 KVA West. Cond., geared, 3/60/2400 volt, 6000/900 RPM.
500 KVA G. E.—Terry, Non-cond., geared, 3/60—120/208 volt, 1200/4000 RPM, New—Never Used.
375 KVA West. non-cond., geared, 3/60/2400 volt, 6000/900 RPM.
375 KVA G. E. cond., 3/60/240/3600 RPM.
187 KVA West. non-cond., geared, 3/60/2300 volt, 7200/900 RPM.
75 KVA Al.Ch.—DeLaval, non-cond., 3/60/240/3600 RPM.

AIR COMPRESSORS

CFM	MAKE	SIZE	TYPE
2312	Ingersoll-Rand	20x20x16	Steam
1400	Ingersoll-Rand	22x14x16	Steam
1156	Ingersoll-Rand	20x12½x16	Steam
1030	Chicago-Pneumatic	19x12x14	Belt
888	Ingersoll-Rand	19x12x16	Belt
599	Ingersoll-Rand	16x10x14	Belt
528	Ingersoll-Rand	14x12	Belt
368	Chicago-Pneumatic	12x7x10	Belt
368	Ingersoll-Rand	12x10	Belt
368	Ingersoll-Rand	10x12x10	Steam
316	Ingersoll-Rand	10x8	Mtr. Dr.
245	Worthington	10x9	Hor. Belt
173	Ingersoll-Rand	9x8	Belt
140	Gardner	8x6	Vert.
136	Gardner	8x8x8	Steam

MARINE GENERATOR SETS—115 VOLT D.C.

1—15 KW Gen. Elec. vertical automatic Steam Engine, 350 RPM.
1—25 KW Crocker-Wheeler—Terry Steam Turbine Set, 3000 RPM
2—25 KW Westinghouse geared Turbine Sets, 1200/5000 RPM.
4—35 KW Gen. Elec. type CC, Steam Turbine Sets, 3600 RPM.
1—35 KW Westinghouse vert. Steam Engine Set, 350 RPM.
1—50 KW Gen. Elec.—Terry Steam Turbine Set, 1800 RPM.
1—80 KW Crocker-Wheeler—Terry 3-unit, 3-wire, 125/250 volt, 2800 RPM.
1—100 Westinghouse Steam Turbine Set, 2400 RPM.

COMPLETE POWER PLANT No. 2
Installed in Pennsylvania—Available as Entirety or Separate Units—includes—

1—4000 KVA Al.Ch. Condensing Turbine, 3/60/2300/3600 RPM.
1—3125 KVA General Electric—Curtis Condensing Turbine, 3/60/2300/3600 RPM.
1—1500 KVA Westinghouse Condensing Turbine, 3/60/-2300/3600 RPM.
6—600 HP Sterling W.T. Boilers, with soft coal stokers.

With above is included condensers, exciters, pumps, switchboards; all accessories for turbines, boiler feed pumps, feed water heaters, coal handling and ash handling equipment, forced draft fans, and all trimmings for boilers.

MOTOR GENERATOR SETS

1000 KW Westinghouse, 250 volt, 720 RPM, 3 phase, 60 cycle, 2300 volt, Syn., A.C. and D.C. Panels.
500 KW Westinghouse 125/250 volt, 900 RPM, 3/60/2300/4100 volt, Syn., A.C. and D.C. Panels, already rebuilt, immediate shipment.
275 KW Allis-Chalmers, 3-unit set, 450 RPM—
150 KW Gen., 150 volt and 125 KW Gen., 240 volt.
400 HP Syn. Motor, 3/60/4500 volt.
2—150 KW Westinghouse Rotary Converters, 250 volt, 6 phase, 1200 RPM with O.C.Bs. and Transformers, 2300/3/60.
150 KW Gen. Elec. type MP, 250 volt, 514 RPM, 200 HP Syn. 3/60/2300.
100 KW Gen. Elec. 125/250 volt, 1200 RPM, 3/60/440.
85 KW West. 250 volt, 135 HP sq. cg., 3/60/220.
75 KW West. 125 volt, 112 HP sq. cage, 3/60/2300/1200 RPM.
75 KW Elec. Mchy. 125 volt, 1200 RPM, 112 HP Syn., 3/60/2200
50 KW Gen. Elec., 250 volt, 3/60/440/900 RPM.
35 KW Fairbanks-Morse, 250 volt, 60 HP Synchronous Motor, 3/60/220/1200 RPM.
25 KW Gen. Elec., 250 volt, 1200 RPM, 3/60/440
25 KW Westinghouse, 125 volt, 1200 RPM, 3/60/220 volt.
5 KW Westinghouse SK, 125 volt, 3/60/220/1800 RPM.

USED LESS THAN ONE YEAR

2—200 ton Frick 4-cyl., Vertical Ammonia Compressors, 360 RPM; with direct connected 300 HP Ideal Synchronous Motors, with cooler, condenser, receiver, etc.

MACHINES JUST LIKE NEW — — PHILADELPHIA STOCK

THE O'BRIEN MACHINERY CO.
PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS
113 NORTH THIRD STREET • PHILADELPHIA - PENNA.
BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN-PHILA

1500 KW MOTOR GENERATOR SET

AVAILABLE IMMEDIATE DELIVERY

1—ALLIS CHALMERS Motor Generator Set consisting of:
1500 KW, 600 Volt Direct Current Generator Direct Connected to a 2190 HP, 3 Phase, 60 Cycle, 4000/6600 Volts, 300 RPM Synchronous Motor.

TURBINE-GENERATOR UNITS

3 phase, 60 cycles

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

1875 KVA Allis condensing 175-200 lb. pressure, 2300 volts, 3600 RPM, complete with direct connected exciter, condenser and condensing auxiliaries.

1563 KVA G.E. condensing 175-200 lb. pressure 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA Allis condensing 200 lb. pressure, 100° superheat, 2300/550/480 volts, 3600 RPM complete with direct connected exciter, and either with a surface or jet condenser. Modern.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

750 KVA G.E. condensing 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

TURBINE-GENERATOR UNITS (Con't.)

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

375 KVA (2) G.E. non-condensing 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter and rheostats.

125 KVA General Electric non-condensing, 150 lb. pressure, 10 lb. gauge back pressure, 240 volts, 3600 RPM, complete direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1000 KVA G.E. 480 volts, 150 RPM direct connected 31" x36" Skinner Uniflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E. 240/480 volts, 150 RPM direct connected 26"x32" Skinner, Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

438 KVA General Electric 2300 volts, 200 RPM alternating current generator direct connected to Busch Sulzer vertical full Diesel engine.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM direct connected to 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. gauge back pressure.

135 KVA General Electric 2300 volts, 277 RPM alternating current generator direct connected to Busch Sulzer *vertical full Diesel engine.*

ENGINE-GENERATOR UNITS

Direct Current

600 KW Crocker - Wheeler 250 volts, 300 RPM direct connected to a 14" x 18", 4 cylinder Ames vertical Unaflow non - condensing engine, 150 to 175 lb. pressure, 5 lb. gauge back pressure complete switchboard and instruments.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non - condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

50 KW General Electric, 125 volts, 1200 RPM direct connected 75 HP Terry non - condensing turbine, 150 lb. pressure, 15 lb. back pressure, complete with switchboard.

MOTORS

3 phase, 60 cycle

875 HP, WESTGH. 440 V., 240 RPM synchronous.

625 HP G.E., type ATI, 2200 volts, 257 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

600 HP Allis 2200 volts, 600 RPM two-bearing slip ring with control.

500 HP General Electric, type MT, 2300 volts, 450 RPM, three-bearing slip ring with control.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

150 HP (2) G.E. 440 volts, 1800 RPM squirrel cage.

125 HP 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

50 HP, type 1, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

300 KVA General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, three bearing belted generator complete with switchboard.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

803 HP, A.S.M.E. code Connelly water tube boiler, 225 lbs. pressure equipped with stoker.

87 HP (3) G.E., type MDS, form A, 230 volts, 500 RPM series wound direct current motors.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

Synchronous condensers 1350 KVA total capacity

750 KVA and 600 KVA, General Electric type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers.

Each unit is complete with direct connected exciter, switchboard panel with instruments.

Are in A#1 operative condition — still on original foundation for operating test.

Utilities Electrical Machinery Corporation

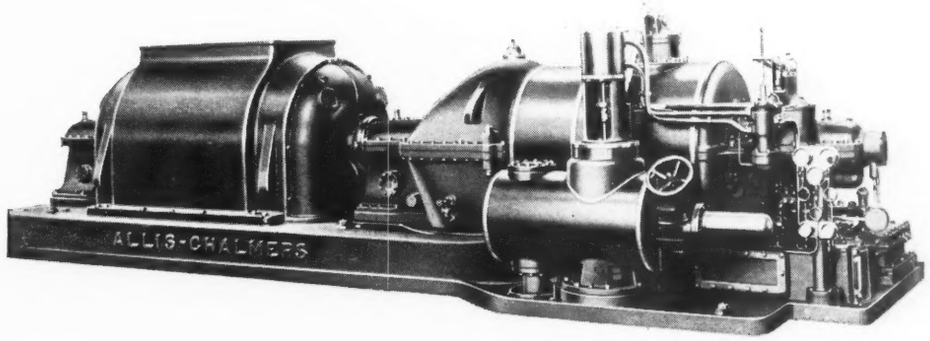
600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—Westinghouse 6250-KVA, 3/60/2300-v, 200# 500°F. TT. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 2500-KVA, 3/60/600-v, 200# 500° F. TT. Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1250 KVA, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

1—G.E., 625-KVA, 3/60/2300-v, 200# 500° TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

MOTORS · GENERATORS · TRANSFORMERS

Prices on Application

3 PHASE, 60 CYCLE, 220/440 V.

HP	Make	RPM	Type	Frame
5	West.	1200	CCL	2 phase
5	American	600	totally enc.	ball bearing
7½	Gen. Elect.	1800	KT	944
7½	Gen. Elect.	1800	KQ	944 2 phase
10	Fairbanks Morse	900	KBY	
10	Crocker Wheeler	900	Nema	365
10	Burke	1800		
15	G. E.	1200	BIS	312
15	Reliance	1200		2 phase
15	Howell	900		2 phase
20	Gen. Elect.	1800	KQ501	2 phase
20	Gen. Elect.	565	I	Form K
25	Gen. Elect.	1740	KQ312	2 phase
25	Armor	1200	ball bearing	2 phase
25	Gen. Elect.	1800	KT	312
30	Gen. Elect.	3600	KT	513
30	Armor	695	ball bearing	2 phase
30	G. E.	1800	KT	332
40	Burke	1200	EM	45
50	West.	1200	MS	
50	Fairbanks Morse	1800	ball bearing	
50	Fairbanks Morse	1800	ball bearing	
50	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Elect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

WANTED

Write—Wire—or Phone

1—125 or 150 H.P. 230 Volt D.C. Motor, 200/1200 RPM. or any 6—1 ratio. Wire if you have this motor.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

HP	Make	Speed	Type	Frame
10	Gen. Elect.	1800	MT	303
15	Gen. Elect.	1800	I	form M
20	Gen. Elect.	545	MT	332
20	Westinghouse	575	CW	648A
20	Westinghouse	575	CW	ball bearing
25	Westinghouse	690	CW	
30	Gen. Elect.	1800	MT	327
30	Gen. Elect.	1800	I	form M
40	Westinghouse	690	CW	748
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
40	Wagner	540	WB	22
50	Westinghouse	700	CW	
50	Westinghouse	900	CW	
60	Westinghouse	720	CW	2200 volt
75	Westinghouse	1800	CW	
300	Gen. Elect.	1200	I	form M
500	Westinghouse	600	CW	

MOTOR GENERATOR SETS

1—150 KW Ridgeway, 250 Volt, D.C., 1200 RPM, Direct Connected to 3 PH., 2300 V. Synchronous Motor—Complete.

1—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP Ridgeway synchronous motors, 3/2200/60/1200 complete with panels.

1—100 KW. Crocker Wheeler 250 v. DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM, complete.

1—75 KW Ridgeway 140 v DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.

1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. Complete.

15 KW. Ideal, 130 volts. D.C., 1800 RPM, direct connected to Ideal motor, 2½ HP, 220 volts DC, 1800 RPM.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
21	25	G. E.	25	2300/230/460
6	40	G. E.	5	2300/230/460
6	30	G. E.	25	2300/115/230
24	50	G. E.	25	2300/230/460
3	50	Packard	25	6900/230/460
18	50	G. E.	60	4160/4600/230/460
3	75	G. E.	60	4160/4600/230/460
18	100	G. E.	60	4160/4600/230/460
3	100	Kuhlman	25	2300/230/460
3	200	G. E.	60	2300/230/460
3	200	G. E.	60	6900/230/460
3	200	Kuhlman	60	4160/4600/230/460
3	500	Pitts.	25	11500/220
3	1000	Pitts.	60	2300/4600/230/460

Prices on Application

3 Phase, 25 Cycle, 440 Volt Motors

Make	HP	RPM	Type	Serial No.
Elec. Machinery	225	500	2200 Volt, Synchronous	
Westinghouse	200	235	CW	2654249
Westinghouse	200	235	CW	2654250
Gen. Electric	150	720	KT	DL163942
Gen. Electric	150	720		3076516
Gen. Electric	150	715		1K15A
Gen. Electric	125	360	I	Slipring
Gen. Electric	100	750		432508
Gen. Electric	75	720	KT357	3948446
Gen. Electric	75	720	KT357	4248476
West. Electric	75	690	1K	1383525
Westinghouse	75	720	CS	4680351
Westinghouse	50	725	CS	1973143
Westinghouse	50	730	CS	2611245
Westinghouse	50	730	CS	1837976
Westinghouse	40	720	CS	128138
Gen. Electric	30	750	1-K	1047632
Burke	25	1500		No Number
Robbins & Myers	20	720		P206014

3 Phase, 25 Cycle, 440 Volt Motors

Make	HP	RPM	Type	Serial No.
Robbins & Myers	20	720		No Number
Crocker Wheeler	15	1500		14655
Westinghouse	15	480	MS	1714973
Westinghouse	10	725	CS	212639A
Robbins & Myers	10	1400		P379687
Allis Chalmers	10	725		3K99481
Westinghouse	10	725	CS	2189307
Westinghouse	10	1455	CS	2185826
Imperial	7½	1440	TEFCBB	116580
Allis Chalmers	5	720		19G1094163
Robbins & Myers	5	1400		P528851
Imperial	5	715	TEFCBB	116754
Imperial	5	715	TEFCBB	116753
Westinghouse	5	1460	CCL	1463694
Gen. Electric	3	710	KT	1689893
Gen. Electric	3	750	KT944BB	KT944
Crocker Wheeler	2	1435		674795
Gen. Electric	1150	375	2300 Volt, Synchronous	

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM.

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 220 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

1—20 HP, Gen. Elec. Motor 230 v. DC. Type CD83 1750 RPM.

1—75 HP. Westinghouse Motor Type SK. 230 v. DC 475/950 RPM variable speed.

FREQUENCY CHANGERS

2—1250 KVA Gen. Elect. Synchronous—motor 3/25/2200 750 RPM. direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

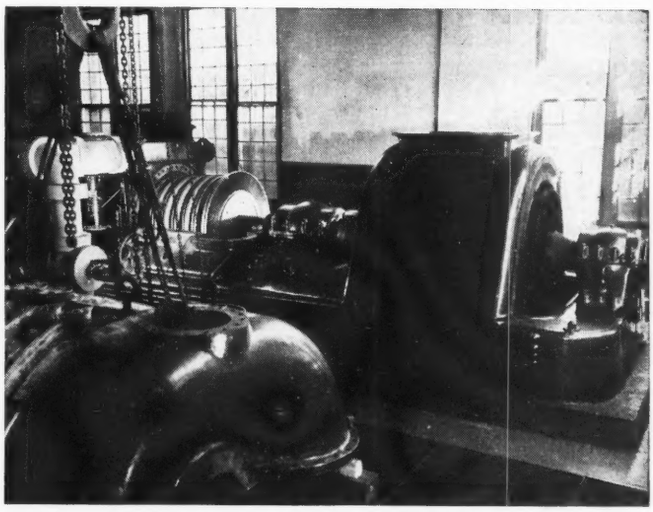
1—200 KW. General Electric 3 ph., 60 cy. 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph., 25 cy. 440 volt, 750 RPM Complete with panels.

1—120 KVA. Gen. Elec. Induction Frequency Changer, 440 V., 3 Phase, 62½ Cycle Driving motor 100 H.P., 3/25/440/720 RPM. Complete.

94 KVA Westinghouse Synchronous Set Generator, 63½ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758



7500 Kw Condensing Turbo-Alternator

7500 KW 80% Curtis General Electric 6-stage Reaction Pattern Condensing Turbo (in record log service performing at 10/11000 KW.) Unit is 60/3/5000/1800 RPM/200# 150° Superheat (has been operated standardly under 250# ISP). Steel steam chest and throttle valve; generator mica insulated. Standard operating temperature rated 40°C. Wheeler Surface Condenser equipped.

CONDITION: In personal disassembly inspection accompanied by parent experts, recently completed, the fact of quality almost equal to new has been verified.

TURBOS—60 cycles

15000 KW performance 40° Impulse and Reaction Semi-Double Flow Condensing unit with non-automatic bleeder facility, 200# design (approved and adaptable with slight changes for 400# and non-automatic in max. volume at either 100# or 65# GPB (single parallel theory for 2300 volts). Surface Condenser and all auxiliaries complete. "In RANGE".

4000 KVA Allis-Parsons design Turbo 60/3/4150 volts Star (perhaps regroupable standard theory 2300 volts Delta). Original design Condensing and operated at 5000 KW for short period, then altered for NC heating by-process load after removal of 4 rows LP blades (would require new blading for condensing). Now Surface Condenser equipped with all standard auxiliaries.

2000 KW rated Allis-Parsons (approx. 3000 KW normal) 60/3/440, no Condenser (would operate efficiently at approx. rated log NC plan at approx. 18# GBP).

2000 KW GE Curtis 6-stage Reaction design 60/3/2300/1800 RPM Condensing and Non-Automatic Bleeder, Surface Condenser equipped. Has log record of 2600 KW constant at 40°. Total log service record 8000 hours (approved non-automatic bleeder theory 30,000# 20# abs. 1800/2000 KW performance.

2000 KW GE Curtis Reaction design 60/3/2300/1800 RPM. Now Barometric Condenser equipped. Officially approved for NC plan at minimum 1500 KW 18# BP. Operators vouch for first-class condition thruout.

TURBOS—25 cycles

25 Cycle Condensing turbos of total approx. capacity of 30/40,000 KW 25/3 various standard voltages. Surface Condensers. Short actual log and first-class condition.

WATER TUBE BOILERS

6-1050 HP Longitudinal Drum Type Box Steel Header 200# 150° Superheat, Chain Grate Stoker equipped. Recent special disassembly inspection approved for 200# re-erection.

2-500 HP B&W Serpentine Steel Header 200# ASME Boilers, No Superheaters, but Chain Grate Stokers, Drive Fans, piping included, Recent inspection approves 200#.

8-400 HP B&W Stirlings powdered coal equipped, Superheaters, Water Cooled Walls and Air-cooled Side Walls, Soot Blowers, Coal and Ash Handling, Forced Draft Fans, Feed Water Heaters, Meters, Gauges, etc. Complete 3200 HP Boiler plant, steel building capable of dismantling, etc. Short log service.

4-500 HP B&W Sectional Header 200#, Chain Grate Stokers.

4-450 HP B&W Straight Tube, 200#, Chain Grate Stokers.

800 HP and 570 HP Erie City Vertical 180#.

2-350 HP and 400 HP B&W Stirlings 180#.

PIONEER PERSONAL SERVICE COOPERATION IN HEAVY POWER

THRU THREE WARS—1892 - 1942

IN INTEGRITY OF PLAN AND PERFORMANCE

BREW–WOLTMAN gives you

1. the benefit of over 35 years of experience–
2. expert knowledge of power equipment values–
3. buying contacts that are necessary to supply your needs–
4. capable and dependable service–

THE PICK OF POWER EQUIPMENT

Available for the War Effort

TURBO UNITS—60 Cy.

1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 937 KVA Moore-Allis N-C. Bleeder
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 200 KW Elliott Non-Condensing
1— 125 KVA Moore Non-Condensing
1— 125 KVA Westinghouse Non-C.
1— 63.5 KVA Westinghouse Non-C.

D.C. Turbo Units

1—600 KW Terry Double Extr. 125 V.
1—500 KW Westinghouse 250 V.
1— 25 KW Westinghouse 125 V.

Steam Engine Units—60 Cy.

1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 150 KVA Hamilton Poppet Valve

DC Steam Engine Units

1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

Oil & Gas Engine Units—60 Cy.

1—1000 KVA Cooper (gas) 240 V.
1— 720 KW McInt.-Seymour 2300 V.
1— 400 KW West. (gas) 440 V.
1— 300 KVA Fair.-Morse 2400 V.
1— 187 KVA McInt.-Seymour 2300 V.

Water Tube Boilers

1—1000 HP Edge Moor 200-lb. Stokers
4—1000 HP Heine 250-lb. oil fired
1— 800 HP Connelly 250-lb. Stoker
4— 750 HP Edge Moor 200-lb.
2— 633 HP Bigelow Hornsby 225-lb.
6— 600 HP Stirling 180-lb. Stokers
2— 520 HP Heine 200-lb. Hand Fired
1— 512 HP Stirling 200-lb. Stoker
2— 490 HP Stirling 200-lb.
8— 400 HP Stirling 200-lb.
1— 400 HP B. & W. 160-lb. Stoker
2— 357 HP Casey-Hedges 175-lb. Stokers
1— 353 HP Edge Moor 178-lb. Stoker
2— 350 HP Stirling 200-lb.
2— 302 HP B. & W. 160-lb. Hand Fired
2— 302 HP B. & W. 200-lb. Hand Fired
1— 300 HP Kingsford 160-lb. Pulverized Coal
2— 282 HP Edge Moor 200-lb. Stokers
1— 253 HP Stirling 180-lb.

Synchronous Motors—60 Cy.

2—800 HP Electric Machy. 6600 V. 450 RPM
1—400 HP Allis Chalmers 2300 V. 600 RPM
1—290 HP Allis Chalmers 2300 V. 600 RPM
1—200 HP General Electric 2200 V. 1800 RPM
1—175 HP General Electric 230 V. 225 RPM
1—175 HP General Electric 220 V. 200 RPM
1—150 HP General Electric 440 V. 164 RPM
1—100 HP General Electric 4000 V 900 RPM
1—100 HP General Electric 2300 V. 240 RPM

Induction Motors—60 Cy.

2—800 HP G. E. slip ring 2300 V. 300 RPM
2—400 HP G. E. slip ring 3800 V. 1800 RPM
2—300 HP G. E. sq. cage 440 V. 600 RPM
2—250 HP G. E. sq. cage 4000 V. 1200 RPM
1—250 HP G. E. slip ring 2200 V. 450 RPM

Air Compressors

1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sullivan Diesel
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1052 Ft. 100-lb. Ing. XRE, 60 cy. motor

Oil Circuit Breakers

1— 800 A. 87 KV Am. Br. Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FK036 Outdoor
2— 600 A. 37 KV Conduit FO40A Outdoor
4— 400 A. 34.5 KV Conduit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
1— 400 A. 25 KV G. E. FKO136 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
1— 400 A. 15 KV G. E. FKO37 Outdoor

Frequency Changers

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G. E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G.E. 25/60 cy. 300 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM

Rotary Converters—60 Cy.

1—1500 KW Westinghouse 250 V.
1—1000 KW Westinghouse, 600 V.
2—1000 KW Westinghoouse, 250 V.
1— 750 KW Westinghouse, 600 V.
2— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

Synchronous Condensers

1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

Transformers—1 Ph. 60 Cy.

3— 600 KVA West. 120,000/2300 V.
1— 5000 KVA Allis. 72000/6600 V. 3 ph.
3— 500 KVA West. 66000/2400 V.
3— 500 KVA West. 33000/2400-4152 V.
3— 500 KVA Allis 33000/480 V.
6— 250 KVA Penn. 34500-17250/4600-2300 V.
1—10000 KVA G. E. 26400 Y/2300 V. 3 ph.
3— 1500 KVA Pitts. 22000/6600 V.
2— 1000 KVA G. E. 23000-11500/575 V.
3— 833 KVA West. 2200/2300 V.
4— 667 KVA West. 22000-11000/2300 V.
3— 250 KVA G. E. 22000/11000 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
3— 500 KVA West. 13200/600 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
3— 150 KVA Pitts. 13800/230 -460 V.
3—1000 KVA Packard 11000/2300-4000 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
3—1250 KVA G. E. 6600/550 V.
3— 833 KVA Penn. 4800/120-240 V.
3— 1000 KVA Pitts. 2300-4600/550 V.
2— 333 KVA Pitts. 2400/220 V.
4— 150 KVA G. E. 2300/115-230 V.
6— 100 KVA Pitts. 2300/575 V.
6— 50 KVA G. E. 2400/240-120 V.

● *Above is only a partial list*

TURBINES
ENGINES
BOILERS

PUMPS
DIESELS
GENERATORS

MOTORS
MOTOR GENERATORS
TRANSFORMERS

ROTARIES
COMPRESSORS
CONDENSERS, ETC.

BREW, WOLTMAN & CO., INC.

50 CHURCH ST. NEW YORK, N. Y.

REBUILT POWER EQUIPMENT

Available Immediate Delivery

ROTARY CONVERTERS

2—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.
2—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor Complete.
1—150 kw. Westinghouse 250 v. 600 rpm., dir. con. 2200/3/60 syn. motor.
125 kw. Crocker Wheeler 250 V. D.C. 1200 rpm., 220/440 v., 3 ph. 60 cy. induction
100 kw. G.E. 550 v. 900 rpm. dir. con. 2200/3/60 Syn. Motor.
1—75 kw. G.E. 250 v. 900 rpm., dir. con. 2300/3/60 Syn. Motor.
1—25 kw. Elec. Machy. 125 v. 1750 rpm., dir. con. 2200 v. 3 ph. 60 cy.
1—16 kw., G.E. 125 v. 1800 rpm., dir. con. 220/440 v. ind. motor.

ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam
1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm., dir. con. Ideal Engine 4 valve non-releasing.

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)
2—120 kw. G.E. 220/440 v. 3 ph. 60 cy. 900 rpm., 80% P.F.

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	rpm.
1	1500	Allis Chal.	ANY	2200	485
1	700	G.E.	MT-432	2200	393
1	400	West.	CW	2200/550/220	435
1	400	West.	CW-967A	220/440	1170
1	300	G.E.	I-M	220/440	600
1	260	Burke	EMV-65	220/440	600
3	250	G.E.	I-M	550	600
3	250	G.E.	I-M	2200/220/440	600
3	200	G.E.	I-M	2200/220/440	600
1	200	G.E.	I-M	2200	514
1	150	G.E.	I-M	220/440	900
1	100	West.	CI	220/440	1750
1	100	G.E.	I-M-16	2200	450
2	100	West.	CW	2200	580
1	75	West.	CW	220	875
1	60	West.	HF	2200	690
1	60	Triumph	C-16	220/440	430
2	60	G.E.	MT-536	2200	1150
1	53	G.E.	I-M	220/550	1165
1	52	G.E.	ITC-5013	220/440	570
2	50	Allis Chal.	ANY	220/440	900
1	50	West.	HF-12A	220/440	900
1	50	West.	CW-461	220/440	900
1	50	G.E.		220/440	850
2	50	West.	HF	220/440	1120
1	50	West.	CW-636A	220/440	1150
2	40	G.E.	MT-332	220/440	1155
1	40	G.E.	MTC-5522	220/440	1125
1	40	G.E.	MT-342	220/440	860
1	40	Allis Chal.		220/440	685
1	40	G.E.	MT-552	220/440	575
1	25	West.	MW	220/440	680
	25	West.	CI	220/440	870

SERIES MOTORS—230 v.

1—175 HP G.E. type MD-109¼ 475 rpm.
5— 75 HP G.E. type 211 550 rpm.
1— 68 HP G.E. CO-2007, 475 rpm.
1— 50 HP Shaw.
1— 50 HP West. K-10 (500 v.) 435 rpm.
1— 30 HP G.E. CO-2002, 610 rpm.
1— 15 HP Crocker Wheeler 270 rpm.
6— 2 HP Reliance, 850 rpm.

SYNCHRONOUS MOTORS

1—150 HP. Allis Chal. 2200/3/60 1200 rpm. 70% P.F. 125 v. exciter dir. conn. thru coupling to 4—Falk Reduction Gears, ratio 1200—164 rpm. complete with control.
2—125 kw. G.E. type ATB, 220/440 v. 3 ph. 60 cy. 900 rpm., 80% PF.

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake. 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

SPEED REDUCERS

1—3 HP. Farrell Herringbone double reduction ratio 6 to 1.
1—5 HP. Boston single reduction ratio 9.25 to 1.
7—10 HP. Horsburg double reduction ratio 6 to 1.
2—20 HP. Sturtevant ratio 14.5 to 1.
1—150 HP. Falk Co. ratio 7.31 to 1.
1—450 HP. Kerr Reduction 3800 to 720 rpm.
1—150 HP. R.D. Nuttal ratio 1.6 to 1.

TRANSFORMERS—1 ph. 60 cy.

3—1500 Kva. Pittsburgh Transformers, 22,000 volt Primary, 6900/6600/2200 volt secondary.

No.	Kva.	Pri.	Sec.	Make	Ph.
3	150	22000	6900	Pgh.	
1	150	2200	230/460	G.E.	3 ph.
1	100	2200	110/220	G.E.	
3	100	6600	550/440/220	Pgh.	
2	75	2200	220	Burke	3 ph
2	50	2300	220/440	G.E.	1 ph.
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G.E.	
1	50	2200	220	Burke	
3	50	2200	110/220	West.	
5	50	2200	110/220	G.E.	
1	37½	2300	220/440	Wagner	
3	37	4400	185	West.(Rotary)	
1	30	2200	110/220	G.E.	
25	25	2200	110/220	G.E.	
1	25	550	110/220	G.E.	1 ph.
3	25	2200	110/220	Westg.	1 ph.
3	20	2200	110/220	G.E.	
1	20	1100/2200	110/220	Pgh.	1 ph.
10	15	2200	110/220	G.E.	
3	15	2300	220/440	Pgh.	
3	15	2300	220/440	Pgh.	1 ph.
35	10	2200	110/220	G.E.	
40	10	2200	110/220	West.	
100	7½	2200	110/220	G.E.	
50	7½	2200	110/220	West.	
75	5	2200	110/220	G.E.	
50	5	2200	110/220	West.	
7	5	550	110/220	Pgh.	1 ph.
2	5	6600	110/220	Pgh.	1 ph.

AIR COMPRESSORS

2—260 CFM Chic. Pneu. 12x10, 100# pres. 285 rpm. belt driven by 40 HP G.E. AC slipring Motors.
1—25 cfm. Ingersoll Rand Imperial single cyl.
1—25 cfm. Curtis single cylinder.

SQUIRREL CAGE MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
500	2200/440/220	West.	CS	720
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
400	2200/440/220	West.	CS	600
350	2200/440/220	West.	CS	450
300	2200/440/220	West.	CS	400
250	220/550	G.E.	I-K	720
225	2200/440/220	G.E.	TRE	200
200	220/550	G.E.	I-K	514
200	220/550	G.E.	I-K	600
200	440	G.E.	I-K	720
200	2200/440/220	West.	CS	250
200	220/440	West.	CS	580
200	2200	West.	CS	870
150	550/220/440	G.E.	—	575
150	220/550	G.E.	I-K	450
150	220/440/550	G.E.	I-K	514
125	220/550	G.E.	I-K	850
125	440	G.E.	I-K	514
125	440	G.E.	I-K	450
125	220/550	G.E.	I-K	400
125	440	G.E.	I-K	720

VARIABLE SPEED MOTORS—230 v. dc.

HP	Make	Rpm.	Type
100/125	G.E.	600/720	RC-39
30	West.	850/1275	SK
25	West.	825/1650	SK
20	West.	750/1125	SK
20	West.	575/1150	SK133
20	West.	300/1200	SK-143
10	G.E.	455/750	CD-95
10	West.	850/1275	SK
10	G.E.	625/1250	LC
9½/10	West.	565/1130	S
7½/10	G.E.	500/1500	RLC-114
7½	West.	850/1700	SK
7½	West.	475/950	SK
7½	West.	495/990	SK
7½	Cr. Wh.	385/1155	CM
7½	Cr. Wh.	385/1000	CM
7½	G.E.	500/750/1500	RLC
7½	West.	450/900	SK8OL
7½	West.	560/1680	SA
5	G.E.	400/800	RC-10
4	West.	500/1000	SK
3½	West.	850/1700	SK
3½	West.	400/1600	SA
2½	West.	900/1800	SK
2½	Kimball	550/2200	—
2½	G.E.	500/1000	—
2½	West.	450/900	SK
2	West.	1150/2300	SK
2	G.E.	500/1500	
2	G.E.	500/2000	FC-33
½	Northern	700/2100	—

SQUARING SHEAR

1—40" shear, 18" material. American Steel & Wire Co., Canton, Ohio.

ELEVATOR

1—Westinghouse Elevator, traction type, 3000 lbs. Cap., platform 6x5, 2 gates on car, 4 sets of bi-parting doors, planed steel tees for main guides complete with AC motor and constant pressure control. All automatic.

INDUSTRIAL TRUCKS

3—Elwell Parker Tow Tractors 7' L. x 42" W. x 42" H. 4-16" wheels, ball bearing, 4 wheel steer, 4 wheel drive, 2000# DBP complete with Edison Batteries.
20—300 to 400 lb. small trucks with handles 18" H. x 48" L. x 28" W. all steel—2 wheels 17", 2 wheels 12", roller bearings, mfg'd by Ohio Galvanizing Co.

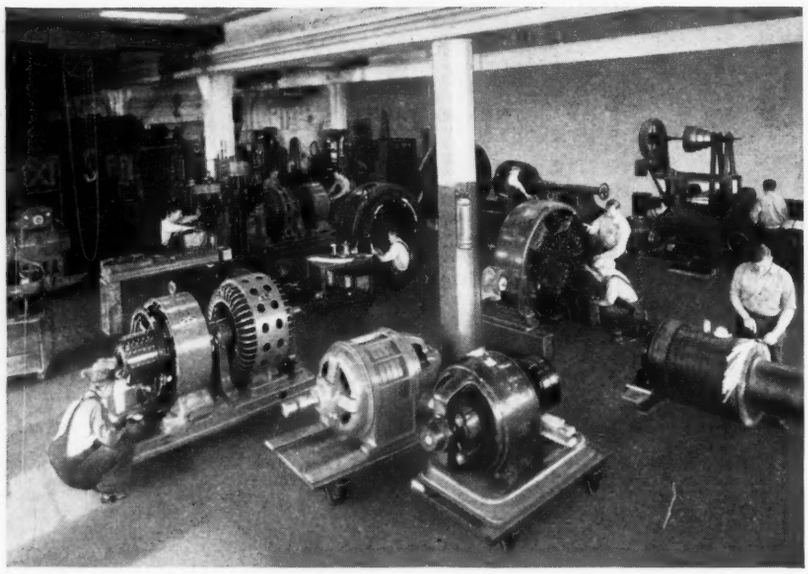
ICE MACHINES

1—7½x7½" Vilter enclosed twin cylinder Ammonia Compressor.
2—25 HP., Arctic Ice Machines driven by 25 HP. A. C. Motors complete with piping, condensers, etc.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS

DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH, PA.



REBUILT POWER EQUIPMENT

--to keep War Work On Schedule!

Now—with war work reaching an all time high, more and more manufacturers are finding that the ideal solution to power equipment shortages lies in the use of rebuilt equipment . . . Chicago Electric is supplying units completely rebuilt and guaranteed—units which perform like new and yet are available immediately.

Chicago Electric "Rebuilts" are serving in the front lines of every wartime industry—standing the rigors of wartime manufacturing to prove conclusively that they are *rebuilt to perform like new units.*

GENERATORS	PLATING GENERATORS
AC & DC MOTORS	WELDING GENERATORS
AIR COMPRESSORS	TRANSFORMERS
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SINGLE MOTORS OR COMPLETE POWER PLANTS

CHICAGO ELECTRIC COMPANY

1320 WEST 22nd STREET • • • CHICAGO, ILLINOIS

Famous for the Highest Standards of Integrity and Dependability

30 Years of Service

★ MOTORS ★ TRANSFORMERS

★ GENERATORS

A Message from

HARRY J. RICE, E.E.

President

STEPHEN HALL & CO.

Mr. Harry J. Rice, E.E., now President of Stephen Hall & Company, Inc., has taken over the complete management of this long-established Company.

There will be no change in the Company policy. Mr. Rice will continue to maintain the same high standards of integrity for which this Company is so well known.

Mr. Rice desires to express his appreciation of the invaluable part played by other Dealers in the growth of this Company. The friendly Dealer relations so long maintained will be continued and extended as opportunity offers.

H. J. Rice

Slip Ring Motors 3 Ph., 60 Cy.

H.P.	Volts	Make	Speed
700	2200	G.E.	900
400 (2)	440	Whse.	514
350	220–440	G.E.	1800
350	2200	G.E.	600
250	440–550	G.E.	600
250	440	Whse. (Hoist)	600
200	2200–440–220	G.E.	600
200	2200–550	G.E.	1800
150	2200	G.E. MT (New)	1800
150	2200–440	Whse.	1800
150	220–440	G.E. MT (New)	1800
150	2200	G.E.	900
100	550	G.E.	900
100	220–440	G.E.	720
100	220–440	G.E.	900
100	550	G.E.	720
100	2200	G.E.	720
80	220–440	G.E. MTC	900
75	440/220	G.E.	600
75	440–220	G.E.	900
75	550	G.E.	900
60	2200	G.E.	720
60	220–440	G.E. MTC	900
50	2200	G.E.	1800
40	2200	G.E.	900

Squirrel Cage Motors

500	220/440	G.E.	IK	900
500	220/440	G.E.	IK	1200
400	2200/550	Whse.	CS	1800
250	2200	G.E.	IK	600
200	440/220	G.E.	IK	720
150	2200–550	Al. Chal.		450
150	550	Cr. Wh.	SC	3600
125	550	G.E.	FT	3600
100	220/440	G.E.	IK	720
100	550	G.E.	KT	900
100	2200	G.E.	IK	600
100	220/440	G.E.	KT	900
100	2200	G.E.	IE-K	1800

SLOW SPEED SYN. MOTORS

1—350 HP—200 RPM—550/440 V 3 ph 60 cy GE 3 brg. Type

1—400 HP—276 RPM—440/220 V 3 ph 60 cy whse 2 brg Type

SLIP RING MOTORS

(2) 400 HP—514 RPM—440/220 V 3 ph 60 cy whse slip ring Type CW 3 brg. Very modern—practically new.

Squirrel Cage Motors (Cont'd)

75	220/440	G.E.	KT	900
75	220/440	G.E.	IK	900
75	2200/550	G.E.	KT	900
75	2200	G.E.	IK	1800
60	220–440	G.E.	KT	900
50	550	G.E.	KT	1800
30	2200	G.E.	KT	1200

Synchronous Motors 3 Ph., 60 cy.

H.P.	Volts	Make	Speed
600	2200	Whse.	900
500	2200/440	G.E.	720
400	440–220	Whse.	276
360	440–220	G.E.	200
200	2300–4000	G.E.	1200
150	2200	G.E. (2)	1800
100	440/220	G.E.	1200
60	220/440	G.E.	300
50	220–440	G.E.	1200

A.C. Generators

500 KVA, 900 rpm—2200 V. Whse. Condenser.
312 KVA, 900 rpm—2200/550 V. Whse.
225 KVA, 600 rpm—2200-480-240 V. G.E.
219 KVA, 200 rpm—480 V. Whse.
187 KVA, 900 rpm—2300-550 V. Whse.
112½ KVA, 900 rpm—240-480 V. G.E.

Transformers—60 Cy.

3—400 KVA, Al. Chal. 4150-2400 Volts.
3—350 KVA, G.E., H-KD 13200/6600-4600.
3—250 KVA Whse. 13200-460/230 Volts.
6—200 KVA G.E. H-KS 2300-230/460 Volts.
3—200 KVA G.E. H-KS 6600/11000-2300 Volts.
3—200 KVA, G.E., H-KD 13800-230/460.
3—200 KVA, G.E., H-KDD 13200/2300/4000Y 25 Cy.
3—150 KVA Whse. 13200-460 Volts 25 cy.
2—150 KVA Whse. ST 13200-220 Volts 3 ph.
3—150 KVA, Pittsburgh 10725-2400.

Transformers—60 Cy. (Cont'd)

2—150 KVA, Whse., ST 3 ph. 13800-230.
1—150 KVA, American 3 ph. 2400/4160Y-120/208Y.
1—150 KVA, G.E., HTQ auto. 220 volt, 3 ph., 220 volt, 2 ph. 3-wire
2—150 KVA, Whse., SK, 4800/4156/3600/2400-480/240/120.
3—100 KVA, G.E., H-KDD 6600/11430Y-2300, 25 cy.
3—100 KVA, Whse., 13200-125/250.
3—100 KVA, Whse, 22,000-2300 volt.
6—100 KVA, G.E., H-KDD 6900/11950Y—230/115 volt.
3—100 KVA, G.E., H-KDD 6600/11430Y-2300 25 cy.
1—100 KVA, Pittsburgh 3 ph. 2300-460.
1— 75 KVA, Whse. Inerteen ST 4160-416/208.
1— 75 KVA, Moloney 3 ph. 2400/4160Y-120/208Y.
2— 75 KVA, G.E., H-KS 2300-230/115.
3— 50 KVA, Whse. SK 22000/11000-2300.
3— 50 KVA, Moloney 2300-230/115.
2— 50 KVA, G.E. H-K 2200-220/110 25 cy.
3— 25 KVA, Whse., S, 2300-575.
3—333 KVA, G.E., H-KD 2400-240/480 V.

Motor Generator Sets

1—100 KW 250 V. 1200 RPM, Ridgway Conn. to 150 HP 2200 V. 3 ph. 60 cy. Syn. Motor.
1—60 KW 125 V. 1200 RPM G.E. Type RC Conn. to ATI 90 HP 4150/2400 V. 3 ph. 60 cy. Synch. Motor.
1—50 KW, 250 V. 1800 RPM Whse. conn. to 75 HP 440/220 V. Sc. Cage (latest type).
1—15 KW 125 V. 1800 RPM G.E. conn. to KT 25 HP 220/440 V. 3 ph. 60 cy. motor.

D.C. Generators

KW	Volts	Make	Type	Speed
200	250	G.E.	CLC	500
125	250	G.E.	DLC	650
100	250	G.E.	CD	1450
75	250	Crocker-Wh.	H	1800
50	250	Crocker-Wh.	H	850
50	125	G.E.	C	725
25	250	G.E.	RC	1750

SYN. CONDENSER

1—500 KVA—900 RPM whse 2200/550 V 3 ph—60 cy syn condenser—dir. conn. exciter.

Instrument Transformers — Compensators — Meters — Drum Controllers — Air Circuit Breakers — Grids Built for Your Application — Switchboards Built to Specifications

Only a partial listing, write or wire your requirements

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

The HEAT is on — America needs more POWER

CHECK THIS LIST OF ITEMS *READY FOR IMMEDIATE DELIVERY!*

★ BOILERS

3—316 H.P. Heine Water Tube Boilers, 180 lbs. pressure, ASME code, complete with Jones 3 retort underfeed stokers, soot blowers, valves and piping, like new.

2—500 H.P. Heine Water Tube Boilers, 200 lbs. pressure, complete with Combustion Engineering Type E underfeed stokers.

★ GENERATOR SETS

1—Ridgway, 750 KW Turbo Generator Set, 1800 RPM, mixed pressure turbine, 230 volt, DC Generator, complete with 3650 sq. ft. Wheeler Surface Condenser.

1—1000 KW General Electric Turbo Generator Set, 3 phase, 60 cycle, 2300 volt, 3600 RPM, turbine, 125 lbs. pressure with low level jet condenser.

★ PUMPS

1—2300 GPM 163 ft. Head 1800 RPM
1—1750 GPM 120 ft. Head 1800 RPM
2—2500 GPM 55 ft. Head 1800 RPM
1—Layne Deep Well Pump 350 GPM with 30 HP motor
1—Layne Deep Well Pump 500 GPM with 40 HP motor

★ STEAM ENGINES

100 KW Skinner Unaflow 150#, 250 RPM direct connected to 115 Volt West. Generator cpd. Interpole

80 HP Chandler & Taylor 13x16 —200 RPM 100# pressure

★ MISCELLANEOUS

45 KW Diehl Cpd. Int. 550 RPM 230 V. D. C. Generator.

1—16 ton 50 ft. span overhead travelling crane, hand operated.

Large lot leather belting (approx. 7 tons)

Large lot new bronze valves 2" to 4"

Steam pumps — Sump pumps

★ WATER TANK

1—16,000 Gal. Water Tower Tank, approx. 12' x 20' with 5" brass tail pipe, ladder, catwalk around tank, railing and 4 leg supports, complete.

★ MOTORS

1—268 HP G.E. Sync. 2300-3-60-600
3—100 HP G.E. Sq.C. 2300-3-60-720
3—75 HP G.E. Sq.C. 2300-3-60-900
4—75 HP G.E. Sq.C. 2300-3-60-720
2—60 HP G.E. Sq.C. 2300-3-60-900
2—50 HP G.E. Sq.C. 2300-3-60-900
2—35 HP G.E. Sq.C. 2300-3-60-900
2—15 HP G.E. Sl. Rg. 550-3-60-900
1—25 HP G.E. Sl. Rg. 550-3-60-900
1—30 HP G.E. Sl. Rg. 220-3-60-900
2—20 HP G.E. Sq.C. 220-3-60-1200
2—75 HP G.E. Syn. Motors, 900 RPM, 220 volt, 3 phase, 60 cycle, with direct connected exciters and compensator.

★ TUBES

12,000 Condenser Tubes 1" OD 20 Gauge Admiralty 18 ft., long like new

HEAT & POWER COMPANY *Inc.*

670 SIXTH AVE. **Chelsea 2-5415** **NEW YORK CITY, N. Y.**

"ELECTRIC" USED EQUIPMENT ··HERE·· IN YOUR PLANT

Means Front Line Equipment Here!

★ **We have over 1000 electrical power units ready to speed production for more war power. This is a special list of unusual items in our stock. Send us all inquiries for standard items. Stock shipment. Rebuilt.**

ALTERNATOR
300 KVA. ATB-440-60/3/720 General Electric

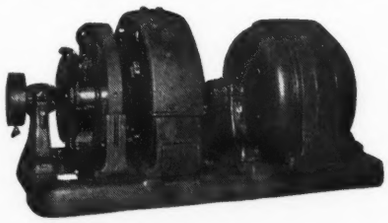
GENERATOR SET
100 KW. 125/250 v. 1200 speed 150 HP. 440-60-3-synch. Drive

GENERATOR SET
75 KW. 125 v. 750 rpm. 115 HP. 25 cy. sq. cg. dr.

TRANSFORMERS
2—100 KVA. 25 cycle, 1 phase 440-110/220 volt, oil type

1000 KW. 250 v. 720 rpm. West. MG set. 2300 v. syn. Drive. AC-DC control!
—PHONE COLLECT IF NEEDED

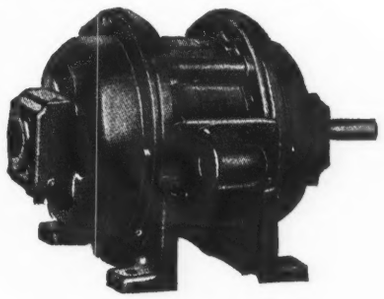
GENERATOR SET
75 KW. 125-1200 Ridgeway, 2200-60-3-Ind. Dr.



COMPENSATOR
400 HP. 440-60-3 Allen Bradley Manual Resistor type

COMPENSATOR
350 HP. GE CR7051. 2200-60-3 with dry auto transformer.

MOTOR
300 HP. G.E. I-K. 440-25/3/1500 speed



MOTOR
500 HP. West. CW-440-25-3-375 rpm. and control

OIL CIRCUIT BREAKER
4000 Amp. G.E. FK 25 600 v. 3 P. Sol. oper.

AIR CIRCUIT BREAKER
4000 Amp. G.E. type C-K 3 pole, 480 volt, 2 trip

ENGINE GENERATOR
1000 KW. 250 v. West. DC. 90 rpm. Cross comp. engine

TRANSFORMER
300 KVA. G.E. Air-Auto 120/208-220 v. 3 phase

GENERATOR SET
100 KW. 250 v. 1750 rpm. Cr. Wh. 150 HP. 2200-60-3-1750 sq. cage

We have large stock 25 cycle equipment in addition to 60 cycle.

PLEASE
Send us your list of idle equipment. Ask for our Catalog. Free.

MOTOR
250 HP. 2200-60-3-1750. Gen. Elec. type KTP

MOTOR
100 HP. G.E. MT356 slip ring 440-60-3-900

MOTOR
200 HP. G.E. I-M 2200-60-3-600 slip ring

GENERATOR SET
800 Amp. 50 v. Hansen 1800 rpm. Welding set, adaptable for Anodic plating

MOTOR
30 HP. Century 1 phase, 220-60-1-1750 rpm. New

MOTOR
100 HP. G.E. I-M 2200. 25-3-375 rpm. slip ring

SAFETY SWITCH
1200 Amp. 250 v. 3 P. S.T. Fuseable

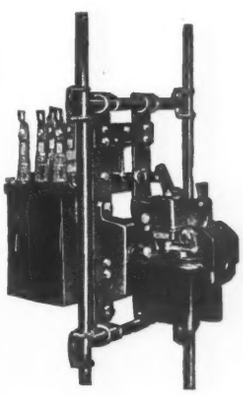
MOTOR
100 HP.-2300-60-3-900 G.E. syn. ATI.

OIL SWITCH
600 Amp. FK 53-B. 15 Kv. In. Cap. 125,000 Kva.

MOTOR
125 HP. G.E. R LC 230 c. 550/1100 rpm.

MOTOR GEN. SET
35 KW. 125 v. Al Ch 1200 rpm. 50 HP. sq. cage drive

SYN. CONDENSER
600 KVA. 550-25/3/500 with exciter and contr.



TRANSFORMERS — SAFETY SWITCHES — CAPACITORS — METERS — PANELBOARDS — COMPENSATORS. REMEMBER—SOME OTHER PLANT CAN USE THE EQUIPMENT YOU DON'T NEED. SEND US YOUR LISTS—WE WILL BUY FOR CASH AND RE-SELL TO DEFENSE PLANTS.

ELECTRIC EQUIPMENT CO.

678 LAKE AVE. **Phone Glenwood 6783** ROCHESTER, N. Y.

WE OPERATE CIRCUIT BREAKER DIVISION

678 LAKE AVE. PHONE: GLENWOOD 6783 - 6784 ROCHESTER, N. Y.

BOILERS

1—2100 HP **Badenhausen** 354# pressure with pulverizers and all auxiliaries.
1—1000 HP **Badenhausen Riley** 200# pressure with pulverizer.
1—955 HP **Sterling** 275# pressure.
1—800 HP **Connelly,** 200# pressure with underfeed stoker.
5—512 HP **Sterling** Class S-26 200# pressure.
1—600 HP **Connelly** 200# pressure.
2—525 HP **Walsh-Weidner** 200# pressure, Coxe Chain Grate Stokers and all auxiliaries.
8—400 HP **Sterling** 200# pressure with pulverized fuel and all auxiliaries.
1—1040 HP **Edge Moor** 200# pressure.
2—289 HP **Sterling Boilers,** 170# pressure with underfeed stokers and all auxiliaries.
2—250 HP **Sterling Boilers,** 160# pressure equipped with gas burners and controls.
2—253 HP **Sterling Boilers,** 160# pressure with oil burners.
2—250 HP **Wicks vertical Boilers** 160# pressure with pulverizers.
1—624 HP **Edge Moor Sectional Header,** 200# pressure Type E stoker.
3—400 HP **Heine Boilers,** 160# pressure with chain grate stokers and auxiliaries.
1—685 HP **Sterling Boilers** 200# pressure with chain grate stoker.
1—650 HP **Sectional Header Boiler** 225# pressure with underfeed stoker.
2—500 HP **Edge Moor Boilers** 200# pressure.
4—500 HP **Voigt Water Tube Boilers** 175# pressure with chain grate stokers and all auxiliaries.
1—440 HP **B & W Sectional Header Boiler** 150# pressure, underfeed stoker.
1—522 HP **Sterling Boiler** 200# pressure with Firite Stoker.
2—484 HP **Springfield Boilers** 200# pressure.
1—520 HP **B&W Sectional Header Boiler,** 200# pressure.
1—**Complete Power Plant** consisting of 2—309 HP **Heine Marine Boilers** 225# pressure and 2 General Electric Turbines with all auxiliaries.
1—200 HP **Scotch Marine** 150# pressure.
2—150 HP **Lebanon HRT Boilers** 150# pressure with all trimmings including pumps and heater.
4—250 HP **HRT Boilers** 150# pressure with all trimmings.
1—300 HP **Locomotive Boiler** 150# pressure with all trimmings.
5—150 HP **Locomotive Boilers** 150# pressure.

TURBINES

1—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts Surface Condenser all auxiliaries.
1—3200 KW **Allis-Chalmers Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Turbine** 400# pressure, Surface Condenser.
1—1000 KW **Westinghouse non-condensing turbine** 350# pressure 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr Non-condensing** 3600 RPM Turbine.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1—125 KW **General Electric non-condensing turbine.**
1—90 KVA **Terry non-condensing turbine.**

ENGINE GENERATOR SETS

1—200 KVA **Harrisburg Uniflow Engine Generator Set.**
1—750 KVA **Rice & Sargent** 3-60-600 volt engine generator.
1—480 KW **Rice & Sargent** 3-60-550 volt engine.
1—375 KVA **Chuse Corliss eng. generator.**
1—375 KVA **Chuse vertical Uniflow engine.**
2—312 KVA **Skinner Uniflow engines.**
1—166 KVA **Ames Uniflow engine generator set.**
2—125 KVA **Skinner Counterflow engine generator sets.**

DIESEL ENGINES

1—300 KVA **Fairbanks-Morse** Full Diesel engine generator set.
1—450 HP **Cooper-Bessemer Tex** rope driven to 300 KW AC Generator.
1—**Complete Gas Engine Plant** consisting of 2—375 KVA **Sterling** and 2—125 KVA **Sterling engines.**
1—**Complete Diesel Plant** consisting of 1—250 KVA **Buckeye Full Diesel,** 1—225 KVA **Atlas Full Diesel,** 1—94 KVA **Caterpillar Diesel.**
5—180 HP **Fairbanks-Morse** Model 35 oil engines.
4—500 HP **Busch-Sulzer** 6 cylinder oil engines used only 300 hours.

MISCELLANEOUS

2—400 GPM **Centrifugal Boiler Feed Pumps.**
1—84" x 12' **self supporting steel stack.**
1—5 retort **Westinghouse Underfeed Stoker.**
1—2000 HP **Cochrane Metering Feed Water Heater.**
1—90,000 lb. **Cochrane Open Feed Water Heater.**
1—10' x 15' **Illinois Forced Draft Chain Grate Stoker.**
1—#8 **Fuller Bonot Pulverizer.**
1—19 HP **Frick** 155# **locomotive Boiler.**
1—100 KVA **Westinghouse** 900 **RPM Gen.**
2—Type AA-6 10 retort **Taylor Underfeed Stokers.**

SEE *Fletcher* FIRST!

FLETCHER SALES CO.

835 Security Trust Bldg. INDIANAPOLIS, IND.

CONSTRUCTION AND DREDGE EQUIPMENT FOR QUICK SALE IMMEDIATE DELIVERY—GOOD CONDITION

Complete equipment from 28" hydraulic dredge, electrically driven, and four electric 28" booster boats equipment, used on one job only.

10—2500 H.P. General Electric Induction Motors—Type MT-28-2500-257 FORM AE, 3 phase, 60 Cycle, 6600 Volts, 257 R.P.M. inc. with starting equipment.

1—1500 H.P. General Electric, Induction Motor—Type M.T.-28-2500-257 FORM AE, 3 Phase, 60 Cycle, 6600 Volts, inc. with starting equipment.

1—700 H.P. General Electric, Induction Motor—completely inclosed. Type M.T.-10-700-720, FORM RE, 60 Cycle, 3 Phase, 6600 Volts, 710 R.P.M., inc. starting equipment.

15—25 K.V.A. Transformers 5940/6600/11430Y

6—15 K.V.A. Transformers to 230 Volts.

11—Pumps, Hydraulic, Centrifugal, complete 33" Intake, 28" discharge.
6—National Transit Pumps—Horizontal duplex piston, capacity 120 g.p.m. at 415 foothead, size 4½" x 10" and 5¼" x 10", 150 g.p.m. at 185 foothead including G.E. Motors, 3 Phase, 60 Cycle 220/440 Volts Induction Motors.
3—Winches—Capstan, Silent Hoist, reversible, barrel diameter 10", 12,000 lb. line pull with rope speed at 30 ft. per minute, complete with 20 H.P. Motor, 3 Phase, 60 Cycle, 220 Volts.
8—Winches, Single drum, Chas. C. Steward Machine Co. electric driven, reversing, 15" drum with capacity of 600 ft. of ¾" wire rope, 10,000 lb. pull at rope speed of 25 ft. per minute, max. rope speed 86.6 ft. per minute, minimum rope speed 21½ ft. per minute, inc. 10 H.P. Motor, Induction, 60 Cycle, 3 Phase 220/440 Volts.
8—Traveling Cranes, Custis Mfg. Co. make minimum span 11' 9⅛", wheel base 6' 6", capacity 20,000 lb., with trolley hoist, Wright, Model BB, hand chain operated.
1—Dredge Ladder, 75' long complete with cutter head, spuds, "A" Frame and Spud wells.
DECK FITTINGS—such as Bollards Kevels and Roller chocks.

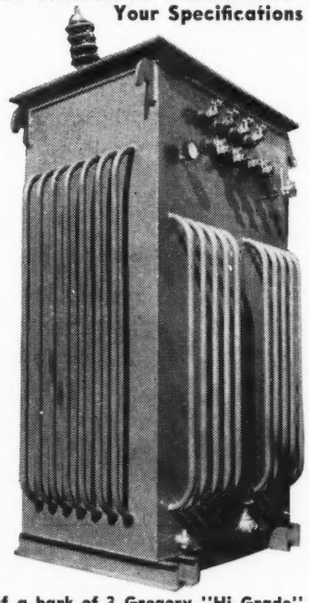
WIRE—WRITE—PHONE

SAMUEL HUBERMAN

223-225 No. 4th St. TEL. EVERGREEN 7-3277 Brooklyn, N. Y.

1893 50th Anniversary Specials 1943

We Are Equipped to Manufacture Power and Distribution Transformers to Your Specifications



One of a bank of 3 Gregory "Hi Grade" transformers in a recent shipment, manufactured from top to base in the Gregory transformer plant. Shown is 500 KVA Type A, Form C, single phase, 60 cycle, 33000/230/460.

REBUILT TRANSFORMERS

SINGLE PHASE (60 cycle)

2— 500 KVA G. E. Type H-D 30,000/460.
6— 75 KVA G. D., 33,000/2300.
3— 75 KVA G. E., Type H, 33,000/230/460.
6— 50 KVA G. E., Type H-D, 33,000/2300.
6— 25 KVA G. E., Type H-D, 33,000/2300.
6— 50 KVA G. E., H-D, 33,000/230/460.
3— 25 KVA G. E., H-KD, 33,000/230/460.
3— 3 KVA Pitts, ODSC, 23,000/2300/460.
8— 75 KVA West, SK, 23,000/2300.
3— 75 KVA West, Type SK, 23,000/460.
6—37½ KVA West, SK, 23,000/2300.
9—37½ KVA West, Type SK, 23,000/460.
3— 25 KVA Gen. Elec., Type H, 23,000/2300.
4— 400 KVA A-L, 13,200/2400/600.
10— 400 KVA A-L, 13,200/600.
3— 75 KVA West, Type SK, 13,200/230/460.
6— 50 KVA G. E., H-KR, 6900/230/460.
9— 25 KVA G. E., H-D, 6900/2300.
3— 15 KVA Pittsburgh, 6600/2300.
30—37½ KVA Wagner, 2300/115/230.
21— 25 KVA G. E., H-K, 2300/115/230.
50— 15 KVA G. E., H-K, 2300/115/230.
30— 15 KVA West., S, 2300/115/230.
27— 10 KVA G. E., H-K, 2300/115/230.
40— 10 KVA West., S., 2300/115/230.
90— 7½ KVA G. E., H-K, 2300/115/230.
250— 5 KVA G. E., H-K, 2300/115/230.

SINGLE PHASE (25 cycle)

13— 10 KVA G. E., Type H, 2300/230/460.
6— 15 KVA G. E., Type H, 2300/230/460.
9— 25 KVA G. E., Type H, 2300/230/460.

Unusually complete lines of other transformers of standard makes, capacities, voltages and frequencies available. Send us your inquiries.

REBUILT TRANSFORMERS (Con't.)

THREE PHASE (60 cycle)

1— 150 KVA Moloney, 11/500/460/230/115.
2— 450 KVA G. E., Type H, 6900/230/460.
3— 600 KVA G. E., Type H, 2300/230/460.
1— 600 KVA West., Type SK, 26,400/2300.

FREQUENCY CHANGERS

1—200 KW G.E. type ATB 3/60/2300 dir. conn. to 300 H.P. G.E. type IK, 3/25/2300. 750 R.P.M.
2—200 KVA G.E., 3/60/2300, 750 R.P.M. dir. conn. to 290 HP G.E. type ATB 3/25/2300 synchronous.

M.G. SETS

1—3 K.W. Hertner, 110 V. D.C. vertical dir. conn. to 7 H.P. 3/60/220/440 V. 1800 r.p.m.
1—40 K.W. Gen. Elec. type CL, 125 V. D.C. dir. conn. to 60 H.P. Gen. Elec. 3/60/440/2300/4000 V. 900 r.p.m.
1—50 K.W. Allis Chalmers, type K, 250 V. D.C. dir. conn. to 75 H.P. Gen. Elec. 3/60/220/440 V. 900 r.p.m.
1—50 K.W. Allis Chalmers, 250 V. D.C. dir. conn. to 75 H.P. Westinghouse 3/60/220/440 V. 900 r.p.m.
1—40 K.W. Gen. Elec., type RC, compound wound dir. conn. to 60 H.P. 3/60/220/440 V. 1200 r.p.m. squirrel cage.
1—60 K.W. G.E. type DLC, 250 V., comp. wound dir. conn. to 125 K.W. G.E. type ATI: .8 p.f., 240/480 volts, 720 r.p.m.
1—100 KW Gen. Elec., 125 volts, dir. conn. to 150 H.P. Gen. Elec., 3/60/2300 V. synchronous motor.
1—150 K.W. Wstghse. Rotary Converter, 250 V. D.C. complete with transformer, starting equipment and D.C. panel.
1—200 K.W. Wstghse. Rotary Converter, 250 V. D.C. complete with transformer, starting equipment and D.C. panel.
1—300 K.W. Allis Chalmers, 600 V. D.C. dir. conn. to Allis Chalmers synchr. 2 bearing unit, 3/60/2300 V. 600 r.p.m.
125 KW Gen. Elec., type MPLI, 250 volts, interpole, dir. conn. to 187½ H.P. Gen. Elec.
60/2300 V. 900 r.p.m. synchronous motor, 100 KW Gen. Elec., type DLC, 250 volts, dir. conn. to 150 H.P. Gen. Elec., type ATB, 3/60/2300 V. 900 r.p.m. synchronous motor.

A.C. GENERATORS

1—225 KVA G. E. type ATB 3/60/220/440 V., 600 R.P.M.
1—187½ K.W. Gen. Elec. .8 p.f. type ATI, dir. conn. exciter, 3/60/240/480 V. 720 r.p.m.
1—150 KVA G.E., type ATB, 3/60/240/480/2300 V., 600 R.P.M.
1—150 KVA Allis Chalmers, 3/60/2300 V. 900 r.p.m. with belted exciter.
1—37½ K.W. Elec. Mchy. .8 p.f. 3/60/240/480/2400 V. 400 r.p.m. with belted exciter.
2—30 KW Gen. Elec., type ATB, p.f. .75, 3/60/220 V., 720 r.p.m. with dir. conn. exciter.

D.C. GENERATORS

65 K.W. Crocker-Wheeler, 500 V., 1750 r.p.m., compound wound.
1—65 K.W. Crocker-Wheeler, 250 V., 1750 r.p.m. compound wound.
1—60 K.W. G.E., type DLC, 250 V., compound wound, 720 r.p.m.
3—50 KW Westinghouse, type SK, 250 volt, 720 r.p.m.

MOTORS—Synchronous

1—225 H.P. G. E., type ATB 3/60/220/440 V., 600 R.P.M.
1—220 H.P. G.E., type ATI, .8 p.f., 3/60/240/480 V., 720 R.P.M.
1— 50 H.P. Elec. Mchy., .8 p.f., 3/60/440/2400 V. 400 r.p.m.

All equipment listed here is owned by us.

50 YEARS OF SERVICE

MOTORS—Slip Ring

1—650 H.P. Westinghouse, type CW, 3/25/440 V., 365 R.P.M.
1—200 H.P. G. E. type IM, 3/60/220/440 V., 600 R.P.M.
1—200 H.P. G.E., type MT, 3/60/220/440 V., 720 R.P.M.
1—175 H.P. Lincoln, frame IXV, 3/60/220/440 V., 600 R.P.M.
1—150 H.P. Gen. Elec., type IM, 3/60/220/440 V., 400 R.P.M.
1—150 H.P. Gen. Elec., type IM, 3/60/220/440 V., 450 R.P.M.
1—150 H.P. Gen. Elec., type IM, 3/60/220/440 V., 600 R.P.M., 3 bearing.
1—125 H.P. Gen. Elec., type IM, 3/60/220/440 V., 600 R.P.M.

MOTORS—Squirrel Cage

1—200 H.P. Westinghouse, type CS, 3/60/220/440 720 R.P.M.
1—200 H.P. G. E., type IK, 3/60/220/440 V., 600 R.P.M.
1—150 H.P. Westinghouse type CS, 3/60/220/440, 1750 r.p.m.
1—150 H.P. G.E., type IK, 3/60/220/440 V., 1200 R.P.M.
1—125 H.P. G. E., type KTP, 3/60/2300 V., 1750 R.P.M.
1—125 H.P. Allis-Chalmers, typeARW frame 258, 3/60/220/440 V. 3500 r.p.m.
1—100 H.P. Allis-Chalmers, type AR, 3/60/220/440 V. 1750 r.p.m.
1—100 H.P. Westinghouse, type CS, 3/60/220/440 V., 720 R.P.M.
1—100 H.P. Crocker-Wheeler, type Q, 3/60/220/440 V., 1200 R.P.M.
1— 75 H.P. Westinghouse, type CS, 3/60/220/440/2200 V., 400 R.P.M.
1— 75 H.P. Wagner, type 31V84RN, 3/60/2200 V., 1200 R.P.M.
1— 75 H.P. G. E., type KT, 3/60/220/440/2200 V., 1200 R.P.M.

D.C. MOTORS

1—100 H.P. Wstghse. No. 5, 2300 V., Crane.
1—125 H.P. Wstghse., 230 Volt, 1100 R.P.M.
1— 60 H.P. Roth, 128RS, 230 V., 1750 R.P.M.
3— 50 H.P. Westinghouse, type SK-160, 230 volts, 500 to 1500 R.P.M.

SINGLE PHASE MOTORS

1— 10 H.P. Century, type RS, 110/220 V., 900 R.P.M., 60 cy.
1— 15 H.P. Wagner, type BA, 110/220 V., 900 R.P.M., 60 cy.
1— 25 H.P. Century, type RS, 110/220 V., 1200 R.P.M., 60 cy.

OIL SWITCHES AND CIRCUIT BREAKERS

Assorted Capacities and Makes at Unusually Low Prices

SWITCHBOARDS A.C. and D.C.

Built to Specifications.
A large stock of A.C. and D.C. SWITCHBOARD INSTRUMENTS and CURRENT TRANSFORMERS

— NEW —

GREGORY "HI-GRADE" Air Cooled Insulated and Auto Transformers. All voltages, capacities and frequencies. Exceptionally fast deliveries on priority orders.

We were in business prior to Manila Bay. We were going strong when Pershing led the A.E.F. to Victory. We will still serve American industry in the American way, long after the Axis is ground into dust. For fifty years the Gregory Electric Company has been a pioneer in the industry. Today, as in the past, the name GREGORY stands for QUALITY.

GREGORY ESTABLISHED 1893 Hi-Grade Rebuilt

GREGORY ELECTRIC COMPANY

2634 SO. WABASH AVENUE CHICAGO, ILLINOIS

NOTEWORTHY EQUIPMENT

MOTORS — ALTERNATORS

TRANSFORMERS — PUMPS

GENERATOR SETS — HOISTS

ROTARY CONVERTERS — COMPRESSORS

Approximately 4000 other AC-DC Motors — Motor Generator Sets — Transformers—Pumps—Fans—Compressors—Hoists, etc.

PENN ELECTRICAL ENGINEERING COMPANY
SCRANTON, PA.

ASHINGTON ELECTRIC EQUIPMENT
ILL BE SHIPPED WHEN YOU WANT IT

ENGINE GEN. SET A.C.
150 K.W. Erie Ball 16x18 4 valve to G.E. 2 or 3 phase 60 cycle 220 volt with dir. conn. exciter, switchboard etc.
Also other A.C. units

MOTOR GEN. SET
50 hp G.E. 440 V 2 phase 60 cy. 860 R.P.M. to 30 K.W. Crocker Wheeler 250 volt D.C. Generator.
Also others, balancing sets, etc.

ENGINE GEN. SET D.C.
100 K.W. Ideal 15x14 Piston valve, to Triumph 3 wire 110/220 Volt 400 amp. with switchboard, balancing coil, etc.
Also several other D.C. units.

STARTER
200 h.p. Allen-Bradley, Bul 640, semi-automatic, 208 volts, 3 phase 60 cycles.
Also others, compensators, regulators, etc.

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60" llg, 2 speed, Ball Bearing 208 volts, 3 phase, 60 cycles, with starter.
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50 h.p. G.E. 3 phase, 60 cycles, 220 volts 900 r.p.m., with compensator.
Also other A.C. and D.C. motors

AIR COMPRESSOR
Chicago Pneumatic, Horizontal, 8"x8", with unloader.
Also other compressors

BLOWER
Garden City, Paddle Blade, Belted type, 29" inlet, 27"x36" outlet, up blast.
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Patterson Kelley—72x144, 3000 gal. Hot Water Heater, 1275 ft. 1¼ O.D. Heating coils.
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We offer—AVAILABLE FOR PROMPT DELIVERY

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CRANES—Locomotive

15 ton Brownhoist, 50′ boom
20 ton Industrial, 50′ boom
25 ton Industrial, 50′ boom

CRANES—Gantry

McMyler Portal Pier, electric
Brownhoist Portal Pier, elec.

CRANES—Crawler

1—yd. Northwest, 45′ boom

CRANES—Overhead

5 ton Shaw, 55′6″ span, 3 motor 220 V.D.C., cab control, box type girders.
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20 ton P&H, 50′ span 3 motor, 110 V. D.C.

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4—450 H.P. B. & W., 180# senous
1—504 H.P. Sterling, 165# Class 2-30
6—600 H.P. B. & W., 183# with stokers
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1—728 H.P. Erie 200# vertical with superheater

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1— 400 C.F.M. Ingersoll-Rand with 75 H.P. A.C. Motor
1—1000 C.F.M. Laidlaw Dunn, steam-dr.
1—1440 C.F.M. Worthington, steam-dr.
1—4000 C.F.M. Nordberg with 750 H.P. Diesel engine

ELECTRICAL EQUIPMENT

GENERATORS

40 KW G. E. Type MP 110 V.D.C. belt drive, 860 RPM, 360 amps.
200 KW Westg. #201 SK, comp. wound, 600 V.D.C. with 290 H.P. syn. motor, 3/60/2200, 900 RPM
300 H.P. Buckeye Diesel Engine & Gen. 3/60/240.
500 KW G.E. Skinner Uniflow Steam Eng. Gen., 250 V. D.C.
100 KW G.E. Type ATB-2-1250-3600 Form T, 814 amps, 3/60/2200-900 RPM
5000 KW Turbo Generator, 3/60/2300 3600 RPM, 185# W.P.
POWER PLANT—Complete with two 625 KW Turbo Generators 3/60/2300, complete with 309 H.P. each Heine Water Tube Boilers, 225# steam pressure

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3 H.P. G.E., 230 V. shunt wound, 1150 RPM
3 H.P. Reliance, 220 V., 600/1200 RPM
3½ H.P. West. Elec., 220 V., 850 RPM
5 H.P. C-W, 220 V., 950 RPM
5 H.P. Watson, Vert., 1300 RPM
5 H.P. G.E., 230 V. comp. wound, 850 RPM
5 H.P. C.W., 230 V., 950 RPM
5 H.P. G.E., 230 V., shunt wound, 1100 RPM
7½ H.P. G.E. Shunt wound, 825 RPM, 230 V. D.C.
7½ H.P. West. #6 Type "S" shunt wound, var. sp.
8 H.P. G.E., 230 V. D.C., 810 RPM
8 H.P. C-W, 220 V., 535/1070 RPM
10 H.P. G.E. shunt wound, 230 V. D.C., 650 RPM
10 H.P. A.C. inter. duty, 220 V. D.C., 500/1200
10 H.P. Triumph shunt wound, 230 V. D.C., 760 RPM
13 H.P. Westg. #8 Type S, 220 V. D.C., var. speed, 375/750 RPM
15 H.P. Westg., 220 V. 500/100 RPM
42/50 H.P. Westg. 220 V. D.C., variable speed 500/1000 RPM, shunt wound

USED A. C. MOTORS

(Squirrel Cage)

15 H.P. Howell, 3/60/440	600 RPM
15 H.P. Gen. Elec., 3/60/220	1200 RPM
15 H.P. West., 3/60/440	850 RPM
15 H.P. Wagner, 3/60/440	850 RPM
20 H.P. Howell, 3/25/440	750 RPM
20 H.P. Westg. Type CCL 3/60/220	850 RPM
20 H.P. Gen. Elec., 3/60/400	900 RPM
25 H.P. A.C., 3/60/220	1200 RPM
25 H.P. West. Elec., 3/60/440	865?RPM
25 H.P. Gen. Elec., 3/60/440	1200 RPM
30 H.P. Westg., 3/60/220	1800 RPM
30 H.P. Westg., 3/60/440	840 RPM
30 H.P. Gen. Elec., 3/60/440	900 RPM
30 H.P. Gen. Elec., 3/60/440	870 RPM
35 H.P. West., 3/60/440	800 RPM
37½ H.P. Lincoln Vert., 3/60/220	1200 RPM
40 H.P. Gen. Elec., 3/60/440	1200 RPM
40 H.P. Gen. Elec., 3/60/440	900 RPM
40 H.P. West. Elec., 3/60/200	1140 RPM
40 H.P. Gen. Elec., 3/60/440	870 RPM
40 H.P. Westg., 3/60/440	870 RPM
50 H.P. Howell, 3/60/440	900 RPM
50 H.P. Watson, 3/60/440	1720 RPM
75 H.P. Gen. Elec., 3/60/440	900 RPM
75 H.P. Westg., 3/25/400	450 RPM

HOIST MOTORS

2—50 H.P. Ft. Wayne Elec. Co. Type "K", 600 RPM, 220 V. D.C.

We also have on hand miscellaneous electrical items, such as:

OIL SWITCHES
OIL CIRCUIT BREAKERS
LIGHTING GENERATORS
COMPENSATORS
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3 phase, 60 cycle, A.C.

2—West. 250 KW 250 Volt rotaries
1—West. 100 KW 250 Volt rotaries
1—West. 150 KW 275 Volt M. G.

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1—G. E. 50 HP 1200 RPM 3 phase 60 cycle 220 Volt
1—Reliance Fan-cooled new 25 HP 1750 RPM 220/440 Volt

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1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

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Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt
G. E. 25 HP 1150 RPM 220 Volt

ADJUSTABLE SPEED D.C. 230 Volt

1—West. Sk-180 100 HP 600/950 RPM
2—Electro Dynamic 60 HP 450/1200 RPM
1—Electro Dynamic 60 HP 525/1100 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
1—G. E. 25 HP 400/1600 RPM
1—Reliance 25 HP 500/1500 RPM
3—G. E. 15 HP 450/1800 RPM
1—G. E. 15 HP 550/1100 RPM
1—G. E. 15 HP 500/1500 RPM
4—Electro Dynamic 15 HP 300/1200 RPM
1—G. E. 10 HP 250/1000 RPM
1—West. 10 HP 400/1600 RPM

ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle

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1200 KW 325 lb. 3600 rpm Turbine only.
2500 KW G.E. 3/60/2300 V. Turbo Gen.
75 HP 3-60-220 V. Fairbanks Diesel Gen.
150 HP Fairbanks Morse "Y" Oil Engines.
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250 KW Nordberg Uniflow 3/60/220 volt.
200 KW 2300 V. Murray Corliss Generator.
200 KW 2300 V. Chuse Corliss Generator.
450 KVA, 4000 volt "Y" Syn. Condenser.
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35 HP 2 Drum & Swinger Clyde Gas Hoist.
85 to 900 HP Steam Boilers 150/250 lb.

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300 KW ROTARY CONVERTER

1—300 KW Westinghouse Rotary Converter, 600 volts D.C. 6 ph. 60 cy., pedestal bearings, 1200 RPM.

TRANSFORMERS

1—750 KVA Uptegraff 3 ph., 6600-4000.
1—100 KVA Pittsburgh 2200-220/440.
3—75 KVA Pittsburgh 4000-220/440.
3—37½ KVA Westghse 4000-230/460.
1—37½ KVA Westghse. 2200-440.
2—37½ KVA Westghse. 2200-110/220.
1—37½ KVA Pittsburgh 2300-230.
1—15 KVA Pittsburgh 550-110/220.
1—10 KVA Allis. Chal. 600-115/230.
1—5 KVA Westghse. 2200-110/220.
10—1½ KVA Gen'l. Elect. 2200-110/220.

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60 KW MOTOR GENERATOR SET

1—60 KW Westinghouse Synch. Motor Gen. Set, Type SK Generator for 125 volts D.C. compound wound, 90 HP. Type G Synch. Motor for 3-60-220 volts, complete with semi-automatic control unit.

MILL AND CRANE MOTORS

CO-2011 MDS-109½, MC-90, CO-1812 MDS-108, CO-2007, CO-1810.

230 V.D.C. MOTORS

1—150 HP., W.E. Co., Type SK, 1750 RPM.
1—75 HP., W.E. Co., Type SK, 575/1150 RPM.
6—20 HP., G. E. Co., Type RC, 1150 RPM.
5—15 HP., G.E., Type LC, 300/600 RPM.
3—13½, W.E. Co., Type SK, 730/1460.
1—15 HP., G. E. Co., Type RC, 850 RPM.
5—15 HP., C. W. Co., Type CM, 1400/1700 RPM.
2—5 HP., G. E. Co., Type RC, 1150 RPM.
1—5 HP., W. E. Co., Type SK, 1100 RPM.
4—3 HP., W. E. Co., Type SK, 1150 RPM.

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TURBINE UNITS (A.C.)

1—750 K.W. **Allis Chal.** 200# steam pressure condensing, with 3 ph., 60 cy., 2300 volt generator. 3600 RPM.

1—600 K.W. **De Laval,** 175# steam pressure condensing, 3 phase, 60 cycle, 2300 volt, 3600 RPM. Fitted with additional nozzles for operating under 125# non-condensing duty at rating of 500 K.W.

1—300 **K.W. Gen. Elec.** 200# steam pressure, 450° T.T., Non-Condensing 2 stage, 3600 RPM., 3 ph., 60 cy., 2300 volt, with direct connected exciter.

1—250 K.W. **Kerr-Elliott** turbine, 200# pressure condensing, fitted for mixed pressure operation at 2# low pressure, combined with 250 K.W. Allis Chalmers 3 ph. 60 cy., 2300 volt generator, 3600 rpm. Direct connected exciter.

TURBINE UNITS (D.C.)

1—750 K.W. **ELLIOTT** MIXED PRESSURE TYPE TURBINE, 1800 RPM., direct connected to 750 K.W. 230/240 volt, 3000 Amp. RIDGWAY D.C. GENERATOR, with C. H. WHEELER SURFACE CONDENSER with Pumps, Cooling Tower, Switchboard and Piping.

1—35 K.W. **Gen. Elec.** 125 volt, 3600 rpm. Non-condensing operation.

MOTOR GENERATOR SETS

1—75 K.W. **Gen. Elec.** 125 Volt, 600 Amp. Interpole D.C. generator, with 115 H.P. Form K. Induction Motor 3 ph., 60 cy., 220/440 volt, 1200 RPM.

1—35 K.W. **Gen. Elec.** 125 volt, 280 amp. DLC generator with 50 H.P. Gen. Elec. 3 ph. 60 cy., 220 volt, 1200 rpm. motor.

BOILER FEED PUMPS

1—**Jeansville Iron Works,** centrifugal, three stage, 4" inlet, 3" outlet, driven by 95 H.P. Terry turbine, 2000 RPM., 235# steam pressure.

1—**Cameron** boiler feed pump, 350 G.P.M. at 724' head, 4" inlet and outlet, four stage, driven by 125 H.P. General Electric slip ring induction motor, 3 ph., 60 cy., 440 volts, 1800 RPM.

1—30" **Worthington** circulating pump, capacity 19,000 GPM, 20' head with 150 H.P. slip ring 3 ph. 60 cy., 440 volt, 400 rpm. motor.

RADOJET AIR PUMP

1—**C. H. Wheeler** Twin Radojet Air Pump with inner and after condenser, 2 stage type.

CONDENSERS

2—900 sq. ft. **C. H. Wheeler** surface condenser.

1—**Schutte & Koertig** Low Level Multi-Jet condenser type #38, suitable for 1000 KW. turbine.

CIRCUIT BREAKERS

2—**Westinghouse** 600 Amp., 15,000 volt, type C.O. 11. Interrupting rating 310,000 K.V. Rebuilt 3 years ago for use at the New York World's Fair and used only two seasons.

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3—150 KVA. **Pittsburgh** single ph., 60 cy., 13,800 volts primary with taps —460/230 volts secy.

3—100 KVA. **Pittsburgh** single ph., 60 cy., 4600-13800 vs. prim—575 vs. secy.

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SLIP RING MOTORS 3-60

100 HP G. E. I-M 440 V 900
60 HP Northwestern 220 V 1200 double end
50 HP Lincoln LXL 220 V 900 hoist duty
40 HP G. E. MT536 440 V 900
20 HP Westinghouse HF 220 V 600
and others

SQUIRREL CAGE MOTORS 3-60

100 HP G. E. I-K 440 V 720
50 HP G. E. I-K 220 V 900
50 HP Crocker Wheeler 21Q 440 V 900
50 HP Allis Chalmers AN 220 V 720
40 HP Westinghouse CS 220 V 3600
40 HP G. E. KT 440 V 720
and others

230 V DC MOTORS

25 HP Westinghouse SK83-1750
20 HP Continental Nema 1150
10 HP G. E. CD75 1150
and others.

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SANDMAN ELECTRIC MOTOR COMPANY

Electrical Engineers

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POWER PLANT EQUIPMENT

ALTERNATORS

KW.	Make	Bearing	Volts	Phase	Cycles	Speed
500	G.E.	3	550	3	60	450
250	G.E.	3	2200/550	3	60	450
250	A-C	2	2200/550	3	60	450
225	F-M	3	550/440	3	60	600
225	G.E.	3	550	3	60	600
200	G.E.	2	2200/440	3	60	720
3—180	G.E.	2	550	3	60	900
125	A-C	2	550	3	60	900
120	G.E.	2	550	3	60	257
3—100	G.E.	2	550	3	60	900
100	West.	1	2200	2	60	300
100	West.	3	550	3	60	300
62½	West.	2	550	3	60	1200
50	West.	2	550	3	60	1200
15	G.E.	2	550	3	60	1800

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We can also manufacture complete Panels to your specifications, or furnish Oil Circuit Breakers, Current Transformers, Meters or Parts.

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Variable Speed

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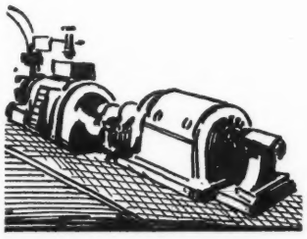
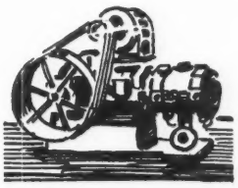


TURBO-GENERATORS

1—3000 KW G.E. 600 V. Cond.
1—2500 KW G.E. 2300 V. Cond.
1— 625 KW Terry-Allis — 600 V. Cond.
1— 500 KW G.E. 240 V. Cond.
1— 500 KW G.E. 2300 V. Mixed P.
1— 500 KW G.E. 600 V. Cond.
1— 175 H. P.G. E. Turbine—only.

BELTED GENERATOR

1—500 KW. G.E. 550 V. 225—RPM



AIR COMPRESSORS

1—2588 Cu. Ft.—AIR — Steam Dr. Cond.
1—782 Cu. Ft.—IR—55#
1—599 Cu. Ft.—IR—2 stage Belted.
1—146 Cu. Ft.—IR—3 stage Belted 2000#.

G.E. CENTRIFUGAL COMPRESSOR

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

BOILERS

2—500 H.P. Heine 200#.
1— 60 H.P. HRT—125#.

WATER WHEEL

1—625 KVA, Morgan Smith 42' Hd.

INDUCED DRAFT FAN

1—126,000 CMF to 210 HP Turbines.
1—165,000 CMF to 450 HP Turbines.

Also transformers, engines and cranes. Send us your inquiries.

A. LEE ELLIS COMPANY

U. S. Machinery Building—BOSTON, MASS.

WHEN YOU NEED MOTOR GENERATOR SETS OR OTHER ELECTRICAL EQUIPMENT

SYNCHRONOUS MOTORS AND ALTERNATORS

		Make	Type	Volts	RPM	Cy.	Cy.	Add. Inform.
6.3	KVA	G.E.	ATI PB	220	1200	3	60	Self Exciter
40	HP	West.	Power-factor 65%	220	1800	3	60	Self Exciter
75	HP	F.W.	VRN	220	1200	3	60	Self Exciter
100	KVA	C.W.		240	900	3	60	Self Exciter
3—125	HP	Ideal	Unity PF	440	300	3	60	Self Exciter
130	HP	G.E.	ATB-PB	220/440	600	3	60	Self Exciter
150	HP	G.E.	ATB-PB	2300	900	3	60	Self Exciter
225	KVA	G.E.	AT17644	440	720	3	60	Self Exciter
300	KVA	G.E.	ATB	600	600	3	60	Self Exciter

TRANSFORMERS

Qu.		Make	Type	Pri. Volts	Sec. Volts	Ph.	Cy.
3—15	KVA	G.E.	H oisc	440	110/220	1	25
1—25	KVA	G.E.	HT-G oisc	6600/13200Y	230/115	3	60
1—30	KVA	G.E.	HT-G oisc	6600/13200Y	460/230	3	60
1—50	KVA	G.E.	H oisc	6600	440	3	25
4—200	KVA	G.E.	H-K oisc	4160	440/220	3	60

SLIPRING

HP	Make	Type	Volts	RPM	Phase	Add. Inform.
200	G.E.	Im	440	600	3	3 Bearing
150	G.E.	IM	2200	720	3	Long Shaft
150	G.E.	IM	440	600	3	
75	G.E.	MT547	220	1200	3	
75	G.E.	MT343	220	1700	3	
75	G.E.	MT343	440	1200	3	
60	Ideal	AVA351	440	600	3	

Write for Our List of Crane and Hoist Motors

D.C. CRANE & HOIST MOTORS

Qu.	HP.	Make	Type	Volt	RPM
3	3	G.E.	CO1803	550	800 series
2	125	G.E.	CO1832	230	675 series
2	100	G.E.	CO1831	230	675 series
1	65	G.E.	CO1811	230	600 series
1	40	West.	K10	230	525 series
3	40	West.	K9	230	575 series
1	35	Northern	KF	230	800 series
1	30	P & H	12x8	230	420 series
1	13	Niles	48C	230	285 series
2	10	West.	HK	550	800 series
1	6	P & H	8x10	110	600 series
2	7½	West.	K4	115	1000 series
1	25	Electro Dynamic		230	550 series wound crane with brake ball bearing
2	10	West.	HK	230	1100 DC
2	7½	G.E.	COm 1805	115	850

PUMPS

No. 4S Gould Centrifugal 600 gpm 50 ft. head 1750 rpm.
No. 5 Cameron Centrifugal 600 gpm 100 ft. head. 30 HP West. SK 230 volt 1750 rpm cpd—factory built.
Fairbanks Morse 860 NE. 25 HP F & M H 12B 2200 volt 1800 rpm 3 BB —factory built.
Size No. 6 Morris Machine Centrifugal pump 123386.
Worthington Centrifugal pump 2 stage. 40 HP West. 220 volt 1800 rpm 3 phase syn. motor 65% P. F. dir. conn. exciter—factory built.
1—Worthington Centrifugal pump 3250 gpm 170 ft. head driven by 200 HP G E. 1E13B 2300 volt 1800 rpm squirrel cage.
1—Worthington 2 stage pump 350 gpm 240 ft. head driven by 40 HP West. synchronous 220 volt 1800 rpm 3 phase motor with direct connected exciter.
5—100 KW G.E. type CDM 250 volt 850 rpm compound wound
1—2000 amp. Condit 3 pole single throw oil breaker 600 volt with handles

We build motor generator sets, gasoline driven generator sets, and other special equipments.

ALL EQUIPMENT LISTED AVAILABLE FOR DELIVERY ON SHORT NOTICE.

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12TH AVENUE & 37TH STREET, BROOKLYN, N. Y.

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MODERN 1000 H.P. POWER HOUSE

1000 HP COAL FIRED POWER HOUSE, DELIVERED THRU BATTERY OF 5-150 HP H.T. BOILERS, A.S.M.E. 150# PRESSURE, EACH INDIVIDUALLY EQUIPPED WITH DETROIT UNDERFEED SINGLE RETORT COAL STOKERS, WITH INDIVIDUAL OVERHEAD HOPPERS FOR LOADING AND FEEDING COAL TO STOKERS. EACH EQUIPPED WITH MULTI-POINTER WATER DRAFT AND WINDOW BOX PRESSURE GAUGES, REGULATOR VALVES AND SAFETY VALVES. EQUIPPED WITH CONVEYOR SYSTEM FOR REMOVAL OF ASHES.

with

VERTICAL STEAM ENGINE, DUPLEX STEAM PUMPS, FANS AND STACKS.

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READY FOR IMMEDIATE SHIPMENT

2—450 H.P. Wintons, 8 cylinder, 4 cycle, 225 RPM, direct reversing.
2—300 H.P. Bessemers, 8 cylinders, 4 cycle, 650 RPM, direct reversing.
240 H.P. Superior, 6 cylinder, 4 cycle, 500 RPM.
240 H.P. Fairbanks-Morse, 4 cylinder, 250 RPM, direct reversing.
200 H.P. Fairbanks-Morse, 4 cylinder, 2 cycle, 257 RPM.
150 H.P. Fairbanks-Morse, 6 cylinder, 400 RPM, direct reversing.
150 H.P. Buda, 6 cylinder, 4 cycle, 900 RPM.
2—150 H.P. Wintons, 6 cylinder, 400 RPM, direct reversing.
2—140 H.P. Fairbanks-Morse, 4 cylinder, 400 RPM, direct reversing.
200 H.P. McIntosh-Seymour Diesel 135 K.W. D.C. Generator Set.
180 H.P. Worthington Diesel 100 K.V.A. Generator Set.
35 K.W. Hercules Diesel Generator Set, A.C.
25 K.W. Winton Diesel Generator Set, D.C.

A. T. METTLER

151 Washington St. Brooklyn, N. Y.
Main 4-3804

1—4000 KW TURBO
4150 V 60 CY 3 PH WITH SUR. COND.

1—3000 KW TURBO
60 CY 3 PH 480 V WITH SUR. COND.

1—12000 FT. SUR. COND. & AUXLS.
HEAT EXCHANGER 606 tubes 1¼x9'6" LONG

1500 CFM. 2 Stage AIR COMP.—SYN. MOTOR DRIVE

500 KW, 250 V. M. G. SET

3—520 HP. GAS. ENGINES

3 - 100 KW 125-250 v. DC. G. E. Turbos
Non-condensing. Exceptional condition

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2 - 800 HP. 60 CY. 3 PH 450 RPM MOTORS WITH AUX.

1 - 2500 HP. 240 RPM 6600 V. 60 CY. 3 PH MOTOR, AUX.

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1000 KW 230 V. Dir. Cur. ENG. SET 120 Rev. 750 kw-110 kw AC Hydro Electric Plant. Others

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Direct Current Generators

1—40 KW C-W Type CCD, 250 v., 1100 RPM
1—45 KW C-W Type CCD, 250 v., 1100 RPM.
1—25 KW GE Type 250 v., 900 RPM Generator.
1—5 KW GE Type CD 250 v. M. G. Set.
1—45 KW GE Type ATB Form P.B. 550 v., 3 ph. Alternator.

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1—Westinghouse CS, 500 HP, 450 rpm, AC motor. Needs rewinding. Will rewind to any speed and voltage within capacity of frame.
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Many transformers, motors, generators, etc.
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Worthington Full Diesel Engine, vertical, 240 HP, 4 cylinder, 2 cycle, 327 RPM, direct connected to General Electric 219 KVA Generator, 2300 volt, 3 phase, 60 cycle. Switchboards.

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1—150 HP, 600 RPM, 3/60/220 Western Electric Sleeve Bearing Motor
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125 KW 3 Phase, 440 Volts, direct connected to Chuse Horizontal Steam Engine, with Governor Switch Board, Exciter, etc.

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For Intermittent Duty

H.P.	Make	R P M	P H
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35	Lincoln HXJ	938	2
30	Lincoln	900	2
27½	A B See H K	600/1200	2
27	Otis	900	3
20	A B See	845	3
	SQUIRREL CAGE		
35	A B See HYK D C-220 V.	720	3
25	Imperial D	700	
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SQUIRREL CAGE MOTORS (3ph. 60 cy.)

HP	Make	Volts	Speed	Type
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450	West.	2200/220/440	50	CS
400 (5)	West.	2200/220/440	500	CS
350	West.	2200/220/440	500	CS
200	Al.Ch.	2200	600	
150	West.	220/440	580	CCL
125/40	Cr.Wh.	2200	700	125 AQ
125	Burke	220/440	1200	
125	Cr.Wh.	2200	700	125 AQ
100	Burke	220/440	900	
100	F. M.	220/440	600	BB

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HP	Make	Type	Speed
15	West.		650
25	Shaw		600
30	G.E.	CO2002	610
35	Cr.Wh.	SM	565
50	Shaw		600
75	G.E.	211 Int.	550
100	G.E.	MD108	480
175	G.E.	MDS 190¾	475

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
700	G.E.	6600	1800
300	Al.Ch.	2200	600
75 (2)	G.E.	2200	900

SLIP RING MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
1000	Al.Ch.	440	235	
700	G.E.	2200	393	MT 432
300	G.E.	440	600	I-M
200	G.E.	2200	600	I-L
200	Cr.Wh.	2300	440	28
200	G.E.	2200	240	MT 412
150	G.E.	220	575	I-M
150	G.E.	2200	600	I-L
125	G.E.	2200	600	I-L
125	Al.Ch.	2200	435	
100	Al.Ch.	220/440	575	
100	G.E.-25 cy.	220/440	500	MI-108

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125 KW Cr. Wh. 250 v. DC—440 v. AC 1200 RPM
100 KW G.E. 550 v. DC—2200 v. 900 RPM
90 KW Al. Chal. 230 v. DC 2200 v. AC 900 RPM

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1—2 Ton Euclid AC with motor driven trolley cab or floor control
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2—2 Ton Sprague 230/500 v. DC Monorail

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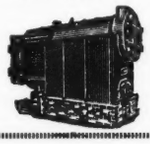

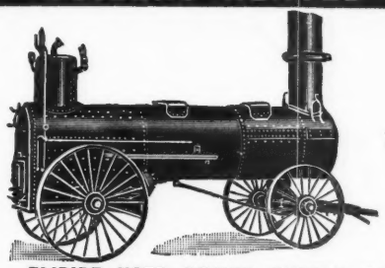

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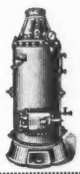

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150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

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200 KW G.E. IND. 250 V. 440 A.C. 720 RPM
200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

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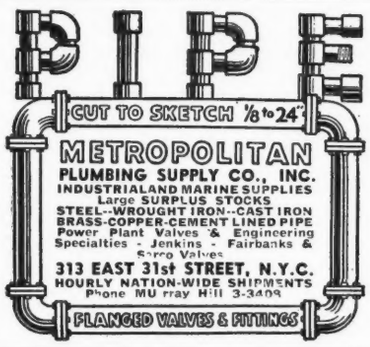
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Complete with Panel.

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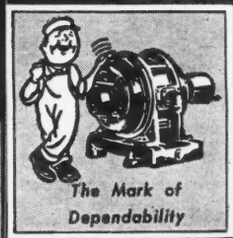

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10—CENTRIFUGAL PUMPS, FROM 1½" TO 3".

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Gear Reduction, 2, 31.

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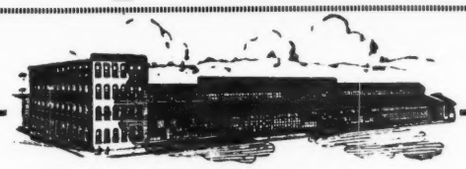

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1—200 HP **Westinghouse,** syn. IPF 3 ph. 60 cy. 2200 V, 600 RPM, with direct connected exciter 3 or 2 bearing

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2—75R, 2200 V, **Fairbanks-Morse,** 1800 RPM, 3 ph. 60 cy. slip ring motors direct connected to 500 GPM 3 stage 300 head pump

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3—75 HP, **Westinghouse,** type SK, frame, 150, 230 V, 1100 RPM.

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1—75 HP, **Allis-Chalmers,** 3 ph. 60 cy. 440 V, 450 RPM, slip ring

1—75 HP, **Westinghouse,** type CW, 3 ph. 60 cy. 440 V, 720 RPM slip ring, 3 or 2 bearing

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1—7½ HP, **Reliance** 230 V, 250/1000 planer

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1—150 KW 3/60/2300 volt 900 RPM **Allis-Chalmers** belted generator

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1—6" **Allis-Chalmers** centrifugal pump, #1022, 800 GPM, 21 ft. head, 860 RPM, mounted on cast iron base for motor drive
1—Single stage **Allis-Chalmers** centrifugal pump, #4199, capacity 450 GPM, 60 ft. head, 1130 RPM, on base for motor drive
1—**Cameron** size 10, double section volute pump, 1470 GPM, 30 ft. head, 870 RPM.
1—**DeLaval Steam Turbine Co.** centrifugal pump #20946, 900 GPM, 1760 RPM, 100 ft. head, direct connected to 3/60/440 volt motor, 30 HP
1—**Jeansville** Centrifugal pump size 3DS, volute, #2884, 500 GPM, 120 ft. head.
1—**Worthington** centrifugal pump, ball bearing, 15 HP, 3510 RPM, 150 ft. head, 300 GPM, 2½" intake, 2" discharge, direct connected on common base to 3/60/220 or 440 volt motor.
2—**Worthington** centrifugal pumps, ball bearing, 3500 RPM, 231 ft. head, 360 GPM, 3" intake, 2½" discharge.

RALPH H. ROGERS & CO.
306 Millsaps Building
Capitol and Roach Streets
JACKSON, MISSISSIPPI

FOR SALE
BOILERS

4—500 H.P. 200 lb. W.P. B & W Serpentine header W.T. Boilers.
2—500 H.P. 200 lb. W. P. Edge Moor W. T. boilers. Complete with Laclede Christie Chain grate stokers and all access.

JOS. SULLIVAN CO.
523 N. Hamlin Ave. Chicago, Ill.
Phone Van Buren 8669

FOR SALE

Brand new duplex **steam pump**, 3 x 1½ x 3 inches.
Rebuilt duplex **steam pump** 2 x ⅞ x 2¾ inches.
3 H.P. **steam engine** in fine condition.
2 H.P. **steam turbine** in fine condition.
12 volt **motors and generators.**
WANTED: Small steam turbine.
WANTED: Small Roots Blower.

American Steam Automobile Co.
West Newton, Mass.

ONE HEINIE 250 H. P. BOILER

180# code construction, all trimmings, two Duplex pumps, feed water heater, main valve and header pipe.

C. E. HOOTMAN
705 Olive St. Louis, Mo.

WANTED

FOR SALE BY OWNER

1—625 Sq. Ft. Wheeler **Surface Condenser** complete with one 20" gate valve, vertical steam driven air and condensate pump and electrically driven centrifugal circulating pump.

1—**Burnham boiler feed pump 12 x 7 x 12** manufactured by Union Steam Pump Co.

1—**Triplex pump size 3½" x 4½"** manufactured by the Platt Iron Works Co.

F.S. 326, Power
330 West 42d St. New York City

-TRANSFORMERS-

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We will be pleased to quote prices on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

FOR SALE
STOKER

Illinois Forced Draft Chain Grate Stoker, with all accessories, suitable for burning bituminous coal. 150 sq. ft. grate surface, drive 10 HP coupled to Reeves Drive. No. 8 American forced draft fan for 5¼ x 6 American Blower, engine included.

FS-314, Power
330 W. 42nd St., New York City

FOR SALE

1—180 H.P. **Allis-Chalmers**, Horiz. 2-Cylinder 16" x 24" Full Diesel Direct Connected to 156.5 Kva. 3/60/2300-Volt Generator.
1—280 H.P. **De La Vergne**, Horiz., 2-Cylinder 20" x 34 Full Diesel Solid Injection, Direct Connected to 240 Kva G-E Generator 3/60/2300 V. Both have Exciters, and Switch Boards

All Ready for shipment—Kansas City.
Write
W. L. Sullivan, P. O. Box 236, Oklahoma City

WANTED

Used 125-150 HP **Water Tube** also HRT **Boilers**, 150-175# working pressure. Stokers for above.

100-125 HP **Steam Turbines** or vertical Troy Engines, suitable high back pressure. Separate or direct conected to 75-100 KW. A.C. Generators.

50-75 ton **Ice Machines** with or without motors.

A.C. **Freight Elevator Head Machinery**, 3000# capacity. **Electric Wires** suitable for 10-50 HP Electric Motors.

HILL PACKING COMPANY
TOPEKA, KANSAS

WANTED

FURNACE

Immediately—One 200# induction type electric furnace or a "U" or "T" size Moore 'Lectromelt furnace. Furnish full information as to age, condition, serial number, price, location, and delivery.

CAMPBELL, WYANT & CANNON FOUNDRY CO.
MUSKEGON, MICHIGAN

FOR SALE

6—**Crosby** 4" ASME Standard **Safety Valves** mounted in pairs on Y Fittings 4 x 4 x 6 125# Operating Pressure.

Little Falls Laundry Company
Little Falls, N. J.

WANT TO BUY
TANKS

3—50,000 to 100,000 gal. Cap. Steel Water Tanks on Steel Towers.

PUMPS

3—750 or 1000 GPM Underwriters Fire Pumps.

RUSSELL STANHOPE
305 Madison Ave. New York, N. Y.

WANTED TO BUY
CRANE

2 ton cap. I Beam Girder Bridge Crane app. 25'0" Span, 2 cable for Bucket Operation
1½ ton 2 cable Monorail for Bucket Operation. Power 220 V. 3 ph. 60 cy.
Give description and Price

W-324, Power
330 W. 42nd St., New York City

Immediate Delivery
UNUSED
Deep Well
TURBINE PUMP

75 g.p.m. 200 ft. total head 7½ h.p. motor., 60 cycle, 3 phase.
No Priority Needed—Bargain

L. F. BEERS
150 Broad St. Rochester, N. Y.

WANTED
DIESEL ENGINES

Total 1600 HP required, with or without Generators. Consider units 225 HP and larger. Also smaller high speed units for standby service. Preference given units immediately available. Give complete details and price.

Address Purchasing Department
W-329, Power
330 West 42nd St., New York City

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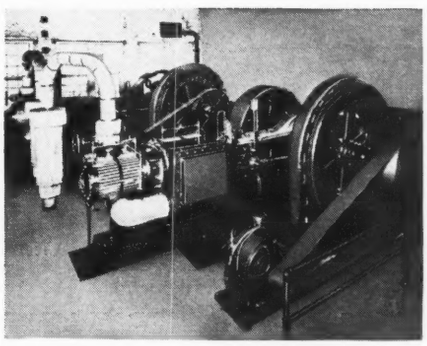
1—250 K.V.A. and 1—300 K.V.A. Crocker-Wheeler Generator direct-connected to Skinner Tandem Compound Steam Engine 480 Volts 3 phase, 60 cycles A.C. 200 RPM plus Switchboard instruments.

Steam Fixtures include Bends and Separators



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39 HYATT AVE., NEWARK, N. J.
Emil A. Schroth, owner

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1—**Westinghouse** factory built 2 bearing **Motor generator set.** Gen. 50 KW-Type S.K. 150 L, 125 V. 1150 speed. Comp. wound driven by 75 H.P. type C.S. 3 ph. 60 cy. 2200 V. 1150 Speed Squirrel cage motor. Will connect to 220 or 440 V. comp. with panel board and starting compensator.

5—**200 H.P. West.** type C.W. 3 ph. 25 cy. 2300 V. 500 speed **slip ring type motors.** 3 without board type bearings and bases.

R. SCHEINERT & SON

2132-34 E. Susquehanna Ave. **Phila., Pa.**

PRICED RIGHT FOR QUICK SALE

2—150-ton Wolfe Linde ICE MACHINES. Cylinders 11¼x21¼" direct connected to Elec. Mcy. Co. 165 HP Engine. Type 3/60/220 V. 100 RPM Motors, DC Excitation P.F. 100% 47 Amps.

1—machine—Chandeyson Motor Generator Set, 40 HP 3/60/220 V. direct connected to 25 KW Generator 1720 RPM 125 volts 160 Amp., 30 HP Cutler-Hammer Auto Transformer Starter.

1—machine—Chandeyson Motor Generator Set, 20 HP 3/60/220 V. direct connected to 15 KW Generator, 125 volts, 120 Amp., 25 HP Starter, 68 Amp., 3/60/220 V.

INDUSTRIAL BUILDINGS CO.

2031 West 74th St. **CHICAGO, ILL.**

PROspect 8770

FOR SALE:

One (1) Cochrane Open Type Boiler Feed Water Heater of approximately 25 H.P. and equipped with trays.

FS-325, Power
330 West 42nd St., New York City

FOR SALE

By the Village of Rantoul, Illinois

250 KW Chuse unaflow engine generator set

Inquire of H. L. Wood, Village Clerk, or of R. D. Wilson & Company, Consulting Engineers, Champaign, Illinois.

FOR SALE

JODIE POWER PLANT EQUIPMENT

In operation September 1942

2—253 H.P.—B. & W. Stirling Water Tube Boilers—Class E—No. 22
2—No. 20. P. S. Iron Fireman Pneumatic Spreader Type Stokers
1—Ball Steam Engine—Horizontal, Single Cylinder No. 5610; 538 H.P. 150 R.P.M., Direct connected to Generator described below:
1—300 K. W. Westinghouse Generator No. 1068665—Type Q Interpole; Compound Wound; 500 Amp., 600 V.
1—Ridgway Steam Engine — Horizontal, Single Cylinder #3632; 328 H.P., 180 R.P.M. Direct connected to Generator described below:
1—200 K.W. Ridgway Generator #2957; Design 40 D 10—Compound Wound, Compensating Fields 333 Amps., 600 Volts; 180 R.P.M. (Cost of Engine & Generator
1—No. 456 Cochrane Feed Water Heater; 1000 B.H.P. 48" x 56" x 90½"
1—McGowan Steam Pump, #19472—Duplex Double Action, Size 7½" x 4½" x 6"
1—Worthington Steam Pump, #709876—Duplex Double Action, Size 7½" x 4½" x 10"
1—Metropolitan Ejector
1—8" Figure 33 Vertical Type Cochrane Steam Separator
1—No. 24 Stirling Steam Trap 150-lbs. Pressure Exhaust Pipe, Fittings, Valves, etc.
1—Whistle
1—Lagonda Air Tube Cleaner
11—Tubes for Boilers
Switchboard and Instruments (Worth today 300% more than when purchased)

Appraised Value 64½% of cost price.

Location: On Chesapeake & Ohio R. R., BRYCE, WEST VIRGINIA

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Will be sold complete or in part

THE GAULEY MOUNTAIN COAL COMPANY

Ansted, Fayette County, West Virginia

TURBINE SET

300 K.W. G.E.
3 ph. 60 cy. 2300 v.
Non-condensing

JAMES K. HOOPER
50 Church Street **New York City**

CRANES & HOISTS

No.	Make	Tons	Span	Motors	Control
1	Shepard	1	Monorail Hoist	2-440-3-60AC	Floor
2	Shepard A	2½	9' Radius	1-220-3-60AC	Floor
	Jib Crane B	4	14' Radius	1-220-3-60AC	Floor
1	Shepard	2	Hoist	3-220VDC	Cab
	with Transfer bridge trucks				
1	Shepard	3	Hoist	2-220VDC	Cab
	with 227' Monorail Runway				
1	Shepard	5	30' 6"	3-220-2-60AC	Floor
	with 400' runway				
1	Lane	5 or 10	50'	2-550-3-60AC	Cab
1	Maris	10	53'	All Hand	Floor
1	Maris	30	20'	All Hand	Floor

Car loading unit with steel runway covering 2 R.R. tracks

SEND SPECIFICATIONS OF CRANE NEEDS

N. B. PAYNE & CO., INC.
105 West 55th Street, New York
Phone: Circle 7-6730

FOR SALE

One 100 K. W. 250 volt D. C. **Turbo Generator Turbine-Curtis** Form C, 2 stage 3600 R.P.M. 150# S.W.P.
Generator—100 K.W. **General Electric** Type MFC, Class 4-100-3600 Form T, 400 Amps, 250 volts D.C.

PILOT MARINE CORP.
25 Beaver Street **New York, New York**

Additional Equipment For Sale Advertising on Page 290

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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10 cents a word, minimum charge $2.00.

(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time salaried employment only), ½ the above rates.

PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. P.

NEW ADVERTISEMENTS received by December 1st will appear in the Mid-December issue, subject to limitation of space available.

OPERATING ENGINEERS — WANTED

Operating engineers who have or have had a Marine Engineers' License. Wages from $300 to $700 per month.

Apply

Local No. 33, M. E. B. A.

227 Fulton Street New York City

FOR SALE

(Continued from page 289)

FOR SALE BY OWNER

ROTARY CONVERTER

1—3500 KW, G.E. Synchronous Booster type 250/310 volts D.C. with a 3800 KVA, 6600/10,900/1200 volts 3 phase, rotary converter type transformer.

SPECIAL

2 Cleveland Crane Co. Motor driven Gantry Cranes, water span 50 ft. land span 40 ft. over 3 railroad tracks—capacity 5- to 7½ tons—2-5 ton Buckets.

TURBO GENERATOR

1—350 KW West. 2300 volt. Non-condensing.

2—400 HP used for three years, good for 125 to 165 lbs. and 7 lbs. back pressure.

1—1000 KW West. Condensing 2300 V.

BOILERS and STOKERS

6—400, 500, 600 and 750 HP Taylor Retort Stokers.

3—520 HP. B & W Superheaters and Stokers.

5—604 HP. Babcock & Wilcox 200 lb.

We specialize in high pressure boiler fittings, Boiler-Supports Superheaters pop safety valves, blow-off valves, steel headers, steam valves up to 600 lbs. up to 24" in diameter, turbine and motor driven boiler feed boilers—high and low pressure pumps.

We make up AC. and DC. switchboards.

Also have in stock oil circuit breakers up to 3,000 amps. and 74,000 volts—disconnect switches up to 6000 amps.

Stock of 5,000 current and potential transformers of all sizes, all kinds of relays, overload, underload, heat element, etc.

We also buy complete plants outright. What have you for sale?

HOWE BROTHERS

324-328 Pearl Street New York, N. Y.

Telephone Nos. Worth 2-2708—2709—2710.

WANTED:

DESIGNER

High grade, designer of High Pressure Water Tube Boilers. Good salary to proper person. Unless thoroughly experienced in Marine and Stationary types, do not apply. Our employees have already been notified of this advertisement.

P-327, Power

330 West 42nd St., New York City

POSITIONS VACANT

(See also "Selling Opportunity Offered")

A PROMINENT MANUFACTURER of pumping equipment has several openings for experienced pump sales engineers, application engineers, and sales correspondents. Applications are invited from men having a knowledge of the pump business. All communications will be considered confidential. Address replies to P-320, Power, 330 W. 42nd St., New York, N. Y.

FIRE PROTECTION ENGINEER and Inspector—Permanent positions open in New York, Pennsylvania, or the Middle West with large industrial fire insurance organization. Previous knowledge in this work not necessary. Applicant must be a technical graduate with manufacturing or engineering experience, and possess a good personality. Several months' training with full pay will be given. Send photo with letter. P-334, Power, 330 W. 42nd St., New York, N. Y.

MECHANICAL ENGINEER, college graduate, qualified to inspect, test and recondition turbines, reduction gears, centrifugal pumps and electric generating equipment at various operation properties of public utility system. Applicant must state salary expected, experience and qualifications. Should be in reasonably good health, free to travel and under age 55. Those employed at their highest skill in war work will not be considered. P-332, Power, 330 W. 42nd St. New York, N. Y.

MECHANICAL ENGINEER, college graduate, qualified to analyze water supply, pumping and distribution system problems and to make plans and recommendations for improvements. Also to analyze operating statistics and make recommendations effecting economies. Employment would be at general offices of public utility system. Applicant must state salary expected, experience and qualifications, should be in reasonably good health, free to travel and under age 55. Those employed at their highest skills in war work will not be considered. Write P-333, Power, 330 W. 42nd St., New York, N. Y.

NEW PRODUCTS WANTED

Due to present priority situation old established national organization with highly trained sales force covering industrial plants, textile mills, coal and oil companies, utilities, transportation companies, municipalities, schools and institutional trade can handle additional products or equipment.

Must be fully patented and protected. Competitive in price with similar items.

Submit complete data stating specifically whether product or equipment has been previously sold and if so extent of sales effort.

We are interested only in an exclusive national selling arrangement.

BO-328, Power

520 No. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertisement service of 32 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives

Salesmen—Additional Lines

OPPORTUNITY OFFERED

PROFITABLE SMALL EQUIPMENT side line now available for bituminous coal and stoker salesmen. Commission. Give details of territory covered. SW-321, Power 330 W. 42nd St., New York, N. Y.

FOR SALE

IMPROVED WILLIS PLANIMETER and Willard horsepower slide rule—$25.00. Owner will ship C.O.D. for your inspection. FS-331, Power, 330 W. 42nd St., New York, N. Y.

DIRECT-CONNECTED Engine-Generator Set—Hoover, Owens, Rentschler Co., cross compound engine. High pressure cylinder, 34" x 54"; low pressure, 68" x 54". 90 RPM, 180 pounds steam pressure. Direct connected to 2000 kw. General Electric direct current generator, type MPC, Class 20-2000-90, form S. Volts: no load, 575; full load, 626. Amperes, 3480. New in 1911; out of service since 1930. Engine complete with condenser and pumps, except circulating pump. Generator complete with panels. Portland General Electric Company, Electric Building, Portland, Oregon.

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FOR AN INDUSTRIAL OR BUSINESS PLANT?

COLUMBUS, NEBRASKA

The City of Power and Progress

Invites you to their city.

HOME OF THE 50,000 H.P. HYDRO ELECTRICAL PLANT.

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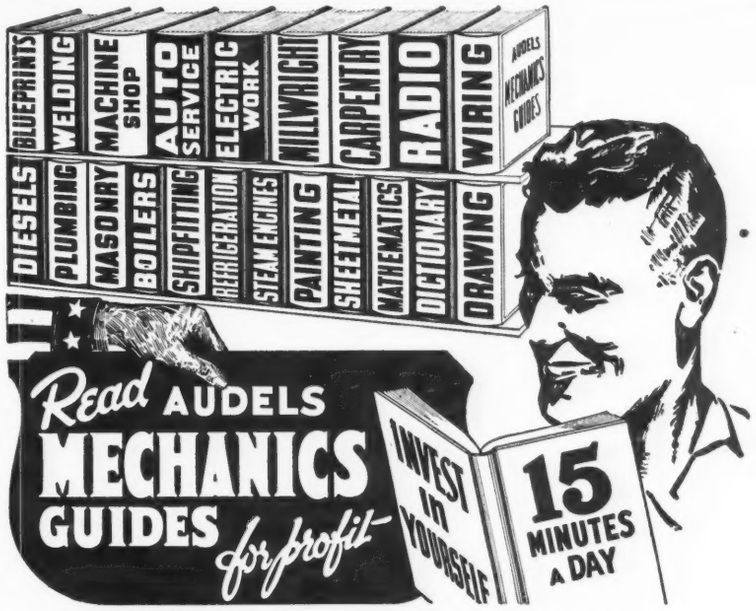

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POWER

DECEMBER 1942
POWER SHOW ISSUE

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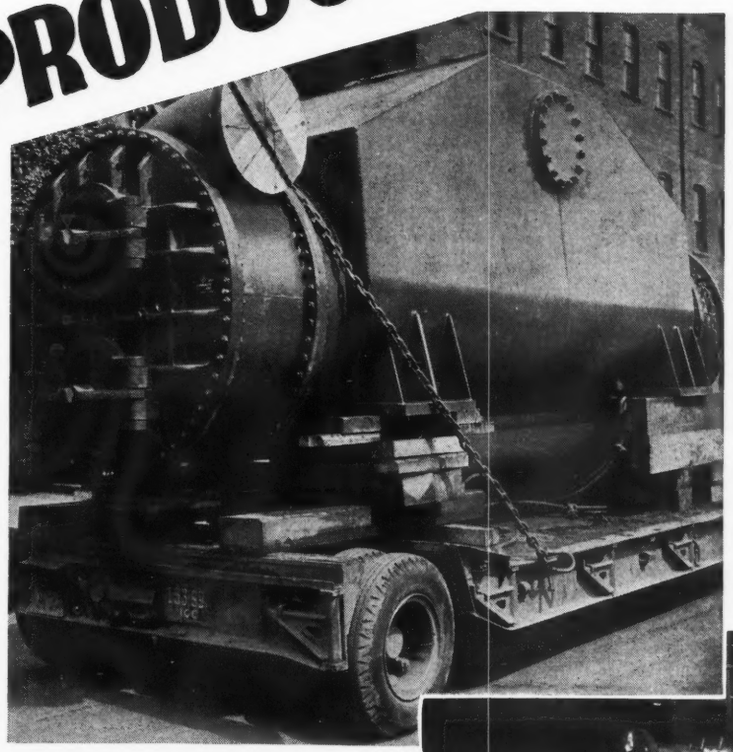
PRODUCTION for VICTORY



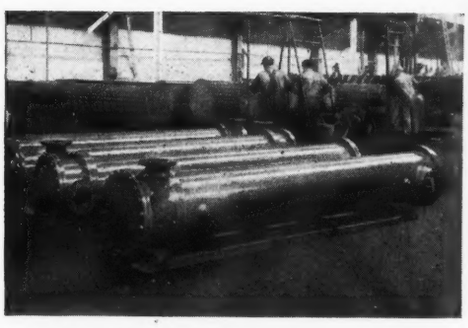
A tough, war-conditioned Heat Exchange industry approaches a second year of war at the highest production levels in history. We, with our industry, swing new war-born tasks along with standard production in this all-out drive for Victory.

4175 sq. ft. POWER PLANT SURFACE CONDENSER

At the left is photograph of a large surface condenser, considered essential to the war effort, to serve a 3000 KW Turbo-Alternator. The castings were produced in one CS&E plant and the unit fabricated in a second plant. Condensate pump, steam jet air ejector and accessories are by CS&E.

78 SURFACE CONDENSERS IN A MONTH

Here again, two plants collaborated in a worth-while war accomplishment. 78 sets of condenser castings were produced in our grey-iron foundry and 78 highest-classification units delivered in a single month. This, in addition to a clock-around schedule of heat exchangers, delivered well in advance of contract requirements.



The maintenance, re-design and rebuilding of existing heat exchangers is the prime war assignment of a third plant.

The production of heat exchangers is under the direct control of the War Production Board; it allocates the right equipment to the right place. Our part is to produce that equipment at the right time. Our men are squeezing every possible unit from the machines and materials available.

If human ingenuity can improve on the present pace of production, we will do it.

CONDENSER SERVICE & ENGINEERING COMPANY

INCORPORATED

HOBOKEN, NEW JERSEY

Hoboken 3-4425

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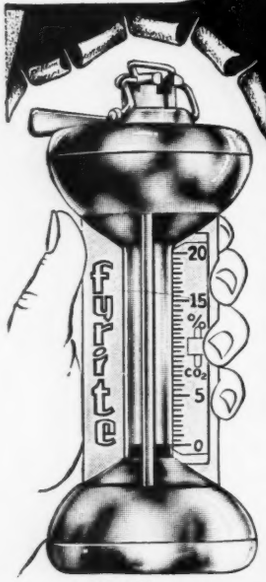
SIMPLIFIED
FYRITE
CO_2 ANALYZER



The amazingly simplified FYRITE "Orsat" CO_2 Analyzer is a practical aid in stretching steaming capacity, cutting fuel consumption, and reducing furnace maintenance. The FYRITE makes flue gas tests easy—quickly indicating necessity of making adjustments that will secure the most efficient combustion. The FYRITE is easy to manipulate; accurate within ½ of 1% CO_2; spill-proof; cold-proof; rugged, durable, compact. More than 7000 are in use.

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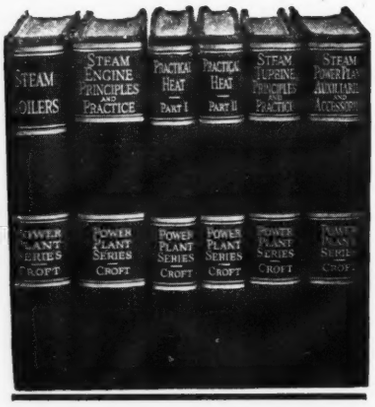
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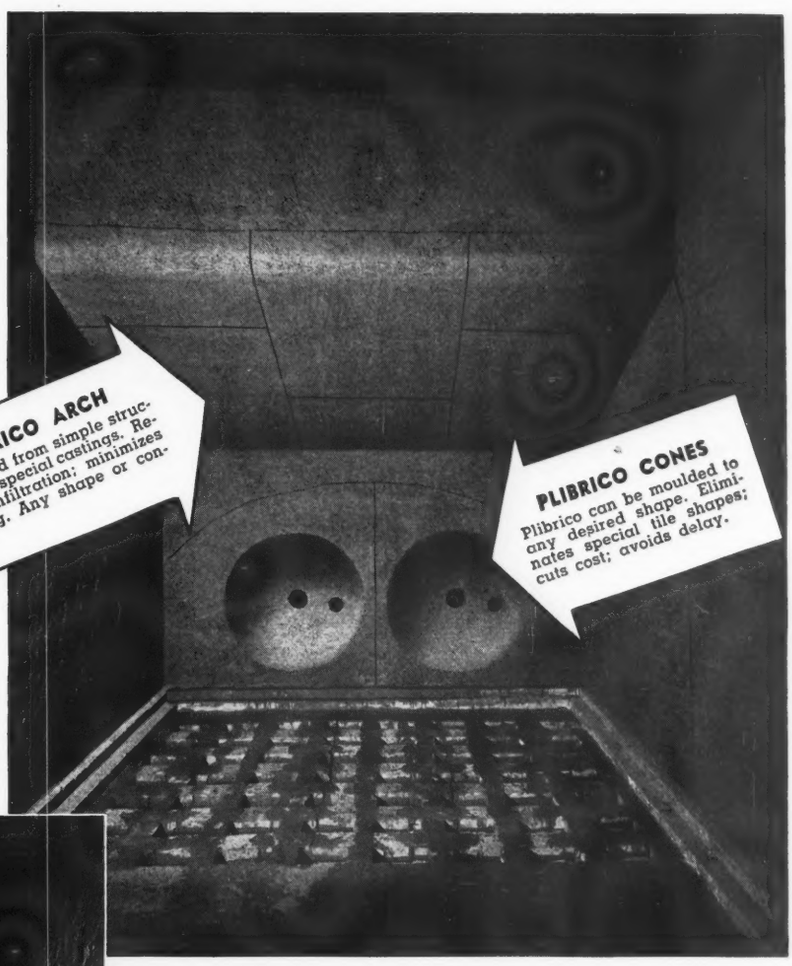
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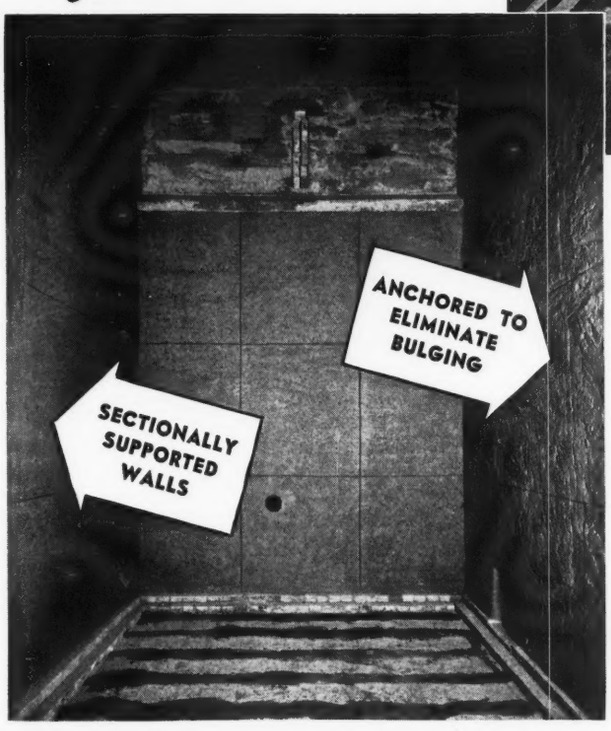

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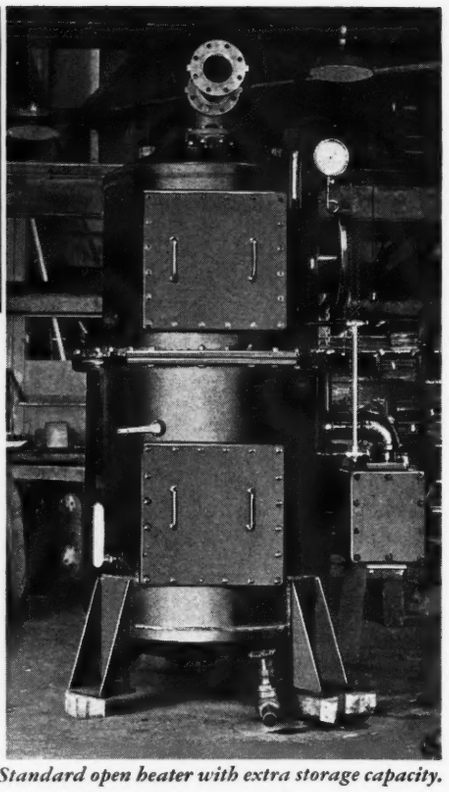
Swartwout Heaters
help your boilers deliver *full capacity*



Standard open heater with extra storage capacity.

Don't neglect the vital "supply-line" of oxygen-free correct temperature water

NOW, with fuel-saving a wartime necessity, the functions performed by your feed water heaters are doubly important. Efficient deaerating eliminates much of the costly boiler cleaning and efficiency-killing corrosion. Correct preheating saves tons of fuel, keeps steam generation at top flow.

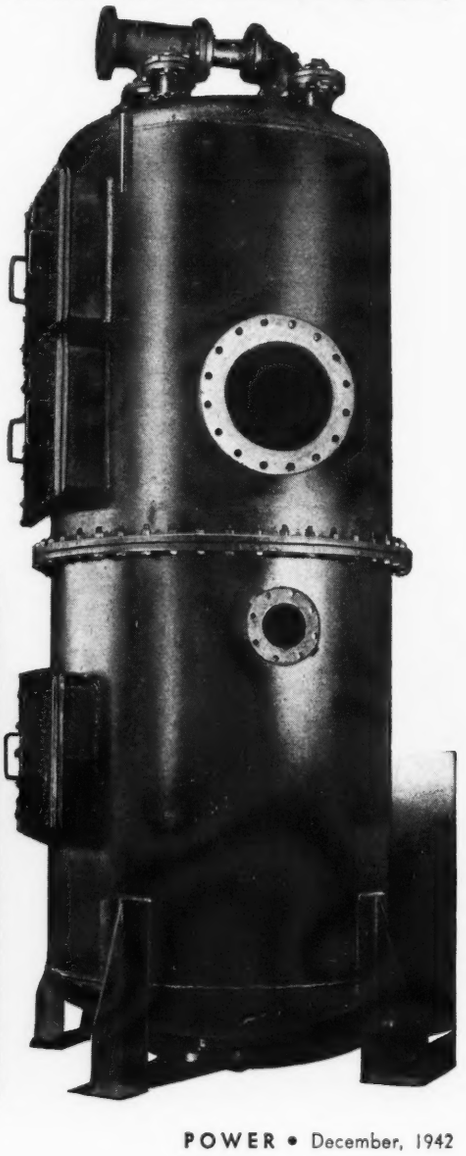
Supplying thousands of boilers in vital defense plants and central stations, are Swartwout Feed Water Heaters of various types—each engineered to fit its job while built to standard time-tried Swartwout principles of design. These principles and the rugged type of construction used guarantee faithful preheating capacity and specified oxygen removal. Write us or ask your consulting engineer about Swartwout Heaters.

THE SWARTWOUT CO., *18501 Euclid Ave., Cleveland, Ohio*

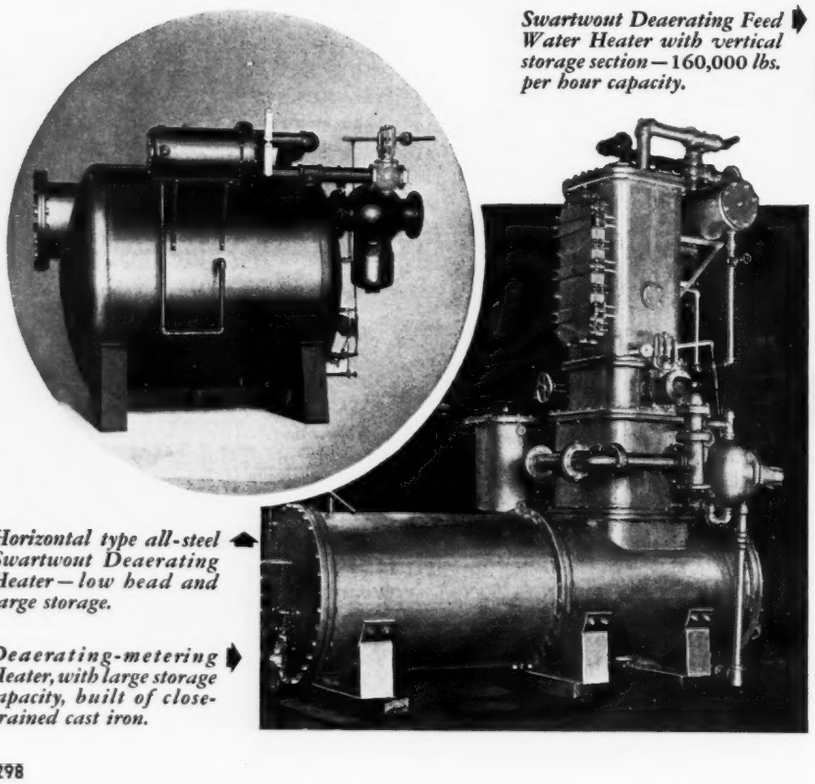
Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

Swartwout

•Power Plant Equipment•

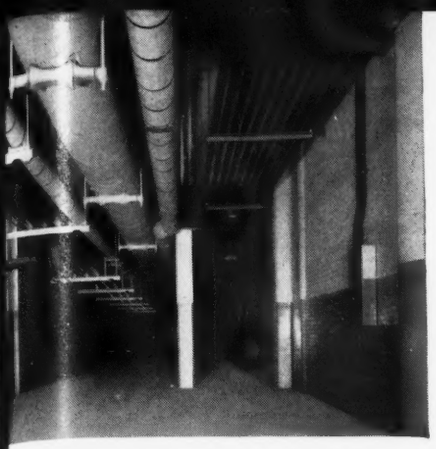


Swartwout Deaerating Feed Water Heater with vertical storage section—160,000 lbs. per hour capacity.



Horizontal type all-steel Swartwout Deaerating Heater—low head and large storage.

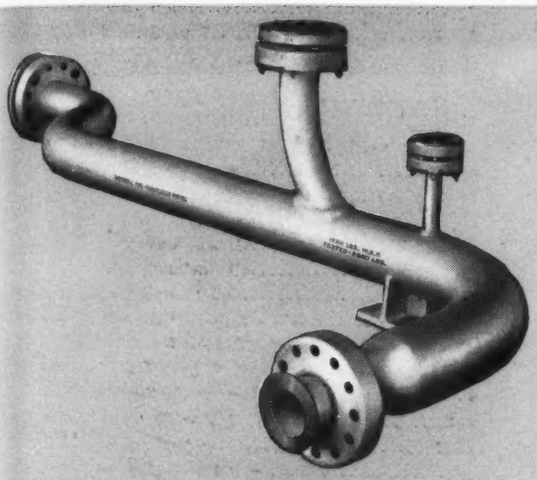
Deaerating-metering Heater, with large storage capacity, built of close-grained cast iron.



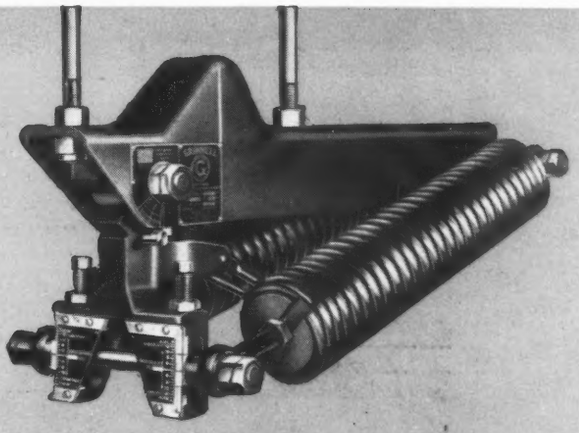
FLUID TRANSPORT - What does it mean? It means carrying steam from a boiler at 2000 pounds per square inch; vapor from a refinery still; gas from a tank; water from a reservoir. It means more than that. It means compensating for such factors as heat and cold, expansion and contraction, pressure – factors as important as the fluid to be transported. It means the manufacture and fabrication of the many connecting links that convert a pile of pipe into a piping system.

GRINNELL

FLUID TRANSPORT

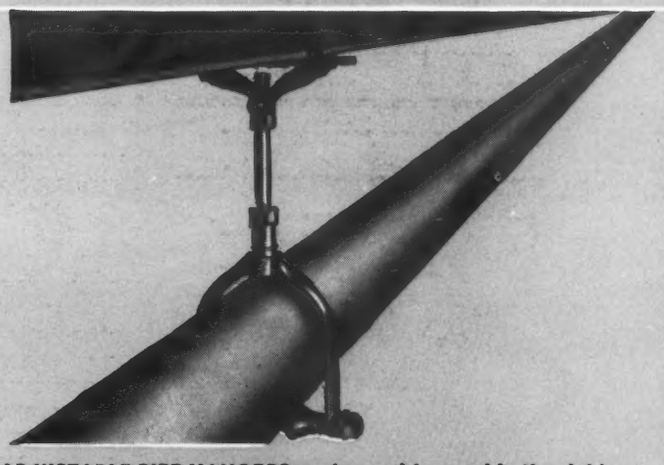


PREFABRICATED PIPING – Complete sub-assemblies pretested for strength, underwriter approved and easy to erect.



2 **GENSPRING CONSTANT-SUPPORT HANGERS – Mass produced, yet prefitted to exact engineered layouts . . . safeguard high-temperature piping systems.**

PIPE AND TUBE FITTINGS – Steel, cast iron, malleable iron, brass, aluminum . . . screwed, flanged, socket, flared tube and welding.



4 **ADJUSTABLE PIPE HANGERS engineered to provide the right hanger for ANY piping ANYWHERE. Faster to install . . . stronger . . . adjustable after installation.**

DATA FOLDERS on these and other Grinnell piping products will be gladly furnished. Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

GRINNELL

WHENEVER PIPING IS INVOLVED

The Eyes Have It

Motor Control plays a vital part in record output of optical glass for victory needs

Much of the manufacture of optical glass for big gun range finders, anti-aircraft height finders and airplane bombsights is shrouded in military secrecy. But it is no secret to Cutler-Hammer Motor Control whose dependability is a password to every arms production plant in the United States. At every complex step in the manufacture of "eyes" for America's armed forces, Cutler-Hammer Motor Control stands guard day and night. For in this hour of America's supreme need there can be no compromises, no delays, no wastes that will hamper or halt the determined drive for victory. CUTLER-HAMMER, Inc., 1358 St. Paul Avenue, Milwaukee, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

1892–1942

CUTLER-HAMMER

MOTOR CONTROL

C-H

50th ANNIVERSARY

Where dependable motor control serves and saves ★

★ ***Motor driven*** machines mine, convey, and refine the sand, silica, lead, lime, barium, zinc, and other minerals that go into optical glass.

★ ***Motor driven*** magnetic separators remove iron impurities from raw material.

★ ***Motor driven*** machines mix, weigh, pulverize and screen the complex mix to be melted into glass.

★ ***Motor driven*** machines thrust loaded clay pots into melting furnaces.

★ ***Motor driven*** agitators keep the mix in motion to insure uniformity and eliminate air bubbles and defects.

★ ***Motor driven*** machines pour the molten glass onto iron tables.

★ ***Motor driven*** rollers flatten the now-plastic glass into sheets.

★ ***Motor driven*** machines carry hot sheets to annealing ovens where internal strains are relieved.

★ ***Motor driven*** machines measure and cut lenses, prisms, and other blanks from the sheets and convey them to re-heating furnaces.

★ ***Motor driven*** presses shape the rough lenses out of the reheated glass.

★ ***Motor driven*** machines grind and polish the rough lenses, prisms, and mirrors within 58 one-hundred-millionths of an inch of absolute accuracy.

★ ***Motor driven*** machines forge, drill, mill, cast, turn, polish the iron, steel, aluminum, and brass mountings and parts that make up the range-finder tubes.

★ ***Motor driven*** machines help assemble the mechanical and optical parts that make up the completed range-finders.

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